UNIVERSIDAD DE ZARAGOZA

FACULTAD DE ECONOMÍA Y EMPRESA

Departamento de Estructura e Historia Económica
y Economía Pública

Choice experiments with best-worst alternatives to understand consumer behaviour: application to peaches with Protected Designation of Origin (PDO) Calanda

Etiénne Groot

Tesis Doctoral

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Tesis doctoral

Memoria presentada por
Etiénne Groot
para optar por el grado de doctor
Director: Dr. Luis Miguel Albisu Aguado
Tutor: Dr. Ramón Barberán Ortí

Zaragoza, 2011

The dictation

“Água mole em pedra dura tanto bate até que fura”
(Water dropping day by day wears the hardest rock away)

always motivated myself.

I would like to dedicate this work to

all insistent people

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Chapter 1: Introduction

1.1 General setting

Spain as well as other Mediterranean countries is known by their traditional diet, “the Mediterranean diet”. The Mediterranean diet is healthy and rich in fresh products, such as fruits and vegetable. In the last decades, Spain has suffered deep socio-economics changes which have had different consequences on society. Nowadays, women spend a great part of the day outside their home because their jobs, families have increased their consumption power and it has affected the diet.

The economic and technological developments have influenced the diet. In the old days people could only consume local and seasonal perishable products but now there are modern techniques that allow maintaining the product quality for longer time and to transport them to farther regions. Thus, the assortment of fresh products can be more diverse and less seasonal. It increases consumers’ welfare and market competition among companies.

To survive, in a competitive environment, companies are forced to improve their technologies as well as their products. According to companies, better products imply expectations of more profitable returns. One way to improve profits is to develop products with profiles more adjusted to consumers’ needs and wishes. Following this tendency, companies have developed foodstuffs more in accordance among their chifts, to consumers’ modern life style and with better taste.

Generally, tastier foods have high contents of fat or are sweeter. These sorts of meals have high concentration of energy and, depending of the total dairy intake, they may affect the health negatively. In order to mitigate the potential consequences of this kind of food on public health, governmental institutions are spending significant effort to promote healthier diets and habits. Information and educative policies are some of the available tools. Subsides and tariffs policies also can be effective for those products that people are sensitive to price.

The competitive environment where companies operate may have repercussions on economic activities with high social and cultural values. In this sense, although designations of origin are an old market instrument, the Protected Designation of Origins (PDO) and Protected Geographic Indications (PGI) were created by European Union to aggregate value to food products and to develop local economies.

There are 301 PDO and PGI in Spain and 16 of them are in Aragon (MMAMRM, 2010b). Aragon is a territorial entity structured by the Spanish Constitution since 1978. It is located in the northeast of Spain and it suffers a severe demographic unbalance on its territory. The agricultural area in Aragon accounts for 48.8% of the total area (IAEST, 2010) and only 16.9% of the entire populations live in rural areas.

The rural areas in Aragon have received subsides to diminish territorial unbalances. One adopted policy has the prupose to enhance products with differentiated quality, such as those with Protected Designation of Origin. In 1999, it was created the Regulatory Council to certify and promote peaches produced in the Calanda area. Overall, the allowed territory to produce peaches with the PDO certification amounts to 45 municipalities (4,654 km^2), which accounts for 9.7% of the Aragon territory.

The main objective of this research is to study the stated consumers' preferences toward late season peaches, given an especial attention to those with PDO Calanda certification, in Zaragoza city. It is expected that the generated information may help different institutions to develop effective policy to promote a heath product as well as to provide useful information to anhance peaches produced in Calanda in a more competitive product.

To achieve this objective, the first phase is dedicated to measure the relative importance of the main attributes of PDO Calanda peaches on purchase decision; the following phase is developed to estimate marginal utilities and, consequently, the marginal willingness-to-pay for different levels of attributes of late season peaches. In the last phase, the attribute importance and attributes-levels (levels of attributes) are measured in the same scale.

Measurements are carried out with Best-Worst Choice Experiment tasks. Consumers had to state the best (or the most important) and the worst (or the least important) options among available alternatives of different choice sets. In each case, global estimations were performed assuming that all consumers had the same preference and preferences heterogeneity was taken into account by different approaches. Table 1.1 summarizes the specific objectives of the study, the nature of the data sources and the method or approach employed for each analysis.

Table 1.1 The specific ends and means of the research

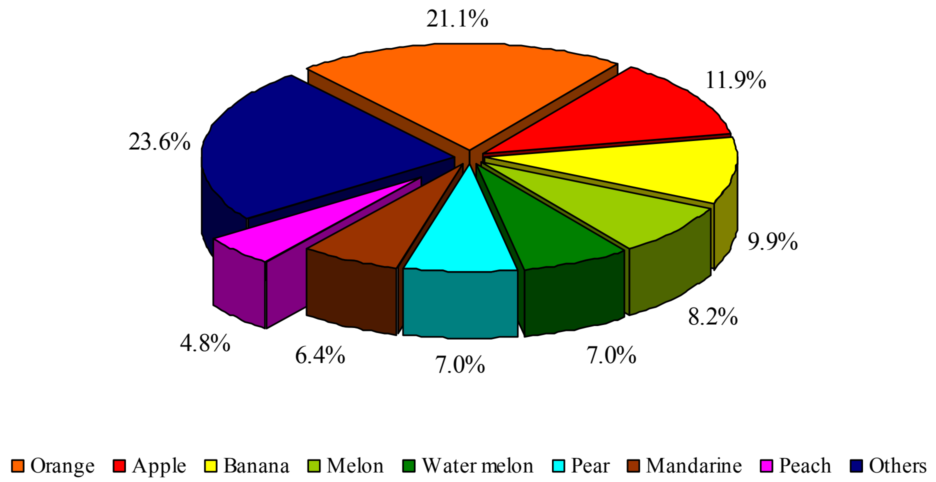
Specific objectives	Source	Method and approach
1. Research justifications	**Secondary data**	- Descriptive analysis
2. Selecting the attributes and levels	**Primary data** - In-depth interviewing - Focus Group - Market monitoring	- Descriptive analysis
3. Knowing consumers' attitudes toward peaches consuption, in general, and PDO Calanda peaches consumption, in particular	**Primary data** - Questions with multiple alternatives - Agreement statements	- Descriptive analysis for all sampled consumers - Bivariante analysis (Chi- square, U of Mann-Whitney and Kolmogorov Smirnov), for consumers ents differentiation
4. Importance of PDO Calanda peaches attributes for all market and different segments	**Primary data** - Best-Worst Discrete Choice Experiment of attributes - Questions with multiple alternatives -	* Best-Worst Score: - Descriptive statistic; Anova test; Pearson correlation; Factorial; Bivariante analysis (U of Mann-Whitney and Kolmogorov Smirnov) * Discrete Choice Models: - MNL models with approaches for the statements of the best, the worst and the best and the worst options choices; Latent Class Analysis.
5. Marginal utility for different attribute-levels of late season peaches at sample and at individual level and WTP only at sample level	**Primary data** - Best-Worst Discrete Choice Experiment of multi-attributes - Hybrid model of Best-Worst Discrete Choice Experiment - Questions with multiple alternatives	* At sample level: - Empirical models for only main effect and main and interaction effects estimations. * At sample and individual levels: - Different Multinomial Logit models (MNL) for: Traditional Discrete Choices; Exploded Discrete Choices; Sequential Best-Worst Discrete Choices; Simultaneous Best-Worst Discrete Choices; the Bottom-up model. * At individual level: - Bivariate analysis (Chi- square, U of Mann-Whitney and Kolmogorov Smirnov), distribution (Kurtosis and skewness)
6. Estimation of attribute-levels utilities and the attribute importance of late season peaches in the same scale for all market and for market segments	**Primary data** - Best-Worst Discrete Choice Experiment of attributes and levels - Questions with multiple alternatives	* Weighted Least Square (WLS) and MNL models: - Marginal and Paired approaches * MNL model: - Mixed logit model - Empirical model with only main effects and main and interactions effects estimation

1.2 Fruit consumption in Spain

A joint expert consultation (by Food and Agricultural Organization (FAO) and for the World Health Organization (WHO)) on diet, nutrition and the prevention of chronic diseases, recommend the intake of a minimum of 400g of fruits and vegetables per day (excluding potatoes and other starchy tubers) to prevent chronic disease (heart disease, cancer, diabetes and obesity), as well as to alleviate micronutrient deficiencies, especially in developing countries (WHO, 2003). Agudo (2004) remind that this amount of intake should be a minimum and not a target. There is a need to take in account cultural and socioeconomic differences between countries when considering promotion of fruits and vegetables.

Spaniards give great importance to fresh products and it is why fruit is one of the most important components of the Mediterranean diet. In 2009, each person ate 95.7kg (262g per capita per day) of fruits and paid on average 1.32€/kg in Spain (MMAMRM, 2010a). Orange was the most consumed fruit (21.1% of total fruit consumption), apple were the second most consumed (11.9%). Peaches took the 8th position with an average consumption of 4.6kg per capita (4.8%) (Graphic 1.1).

Graphic 1.1 Fruit consumption in Spain in 2009

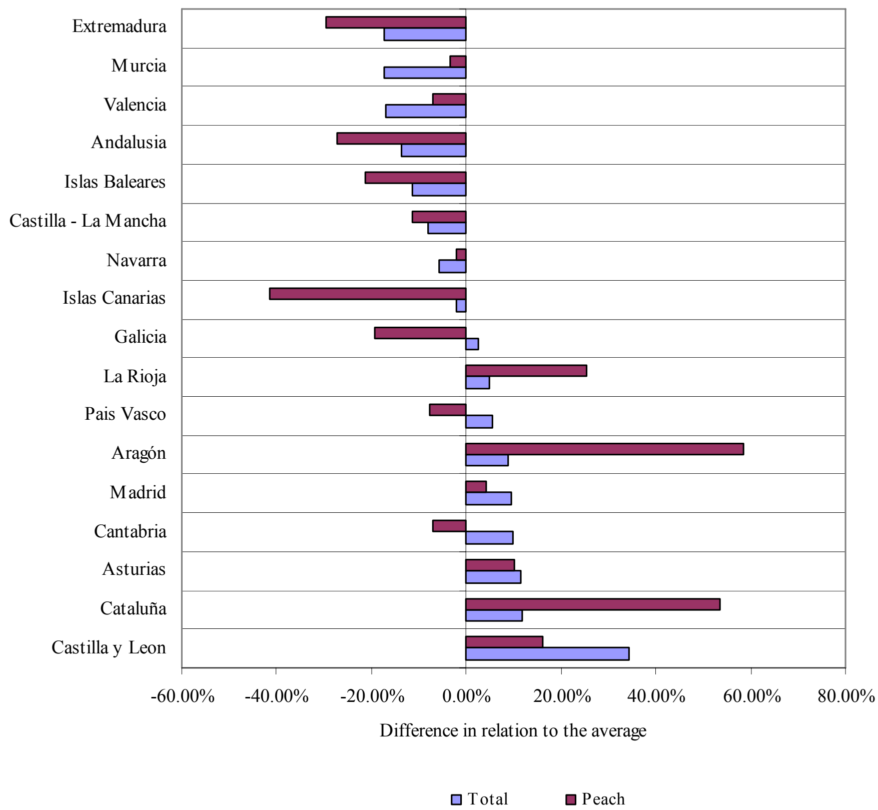


Source: MMAMRM (2010a)

Fruit consumption in Spain is heterogeneous. There are differences in total fruit intake, particularly with respect to the assortment of fruit intake and fruits prices. For example, in 2009, in Castilla y Leon each person ate 128.5kg of fruit (it is 34.3% higher than the national consumption) (Graphic 1.2), while in Extremadura, Murcia and Valencia fruit consumption was around 76.2kg per capita (17% below the national average). Oranges were the main consumed fruit in all Spanish regions and its consumption varied from 12.0kg per person in Valencia to 32.0kg in Castilla y Leon. Apples were the second most consumed fruit in 12 regions and it lowest consumption is found in Extremadura (7.2kg per capita) and the highest in Asturias (11.9kg per capita).

While the national consumption of peaches was 4.6kg per capita, it was found the highest consumption (7.29kg per capita or 58.9% higher than the national average) in Aragón (Graphic 1.2). Islas Canarias presented the lowest peach consumption, with only 2.7kg per capita or 41.3% below the national average.

Graphic 1.2 Total fruit and peach consumption in different Spanish regions in 2009



Source: MMAMRM (2010a)

Spaniards spent 1,419 Euros per capita to purchase food in 2009 and 8.9% (126.0€) of this amount was dedicated for purchase fruits. Considering the fruit consumption and expenditures, the average price of fruits was 1.32€/kg, but this value varied among different regions. On average, it was paid 1.19€ per kilogram of fruit in Extremadura and 1.47€/kg in Islas Canarias. This difference of average price can be explained by the sort of fruits consumed and their price. For example, oranges had an average price of 0.83€/kg and they were consumed with the highest proportion (24.5% of total consumption – in quantity) in Extremadura while oranges were sold in Islas Canarias by 1.01€/kg and they accounted for 19.7% of total fruit consumption in this region.

Fruit prices and demands are different among fruits. For example, cherries average price was 2.64€/kg (100% higher than the average price of all fruits) and they were demanded 1.5kg per capita in 2009; avocados average price was 2.63€/kg (99.24% higher than the average price of all fruits) and their consumption was only 0.5kg per capita. Oranges and apples prices were 0.89€/kg (32.6% below the average price of all fruits) and 1.23€/kg (6.8% below the average price of all fruits), respectively, in this period. In the case of peaches, their average price was 1.41€/kg, which presented a difference of 6.8% respect with the average price of all fruits, and their highest price (1.63€/kg) was found in Islas Canarias and the lowest (1.26€/kg) in Aragon.

Family budget may influence fruit purchase but there are other factors that influence fruit consumption. Expenditure weight, on food purchasing, with respect to total expenditure has decreased in the last 50 years. Spaniards spent 55.3% of their household income to purchase food in 1958 and this percentage decreased to 38.0% in 1973/74, to 29.1% in 1985 (INE, 1988) and it was only 14.4% in 2009 (INE, 2010b). However, fruit consumption per capita, increased from 79.0kg in 1970 to 132.0kg in 1975 and this value was 144.2kg in 1980. As seen earlier, fruit consumption decreased to 95.7kg per capita in 2009. Apparently, budgetary restrictions had great influence until 1980 but, now, other factors may be influencing fruit consumption.

The amount of food demanded is stable since 2000 and expenditures have increased since then, which means that Spaniards are demanding products with higher quality (MAPA, 2006). Farmers are interested players of the overall strategies aiming to increase fruit and vegetable consumption as they are likely motivated by expectations of economic returns.

A great part of the Spanish population (52.8%) declares that health is the main factor that they consider when choosing food. However, healthy problems, such as cholesterol excess as well as obesity are quite common in the Spanish population, which reinforces the idea that the relationship between food and health is a complex issue. A multidisciplinary study should be addressed in order to know the true factors and restrictions that drive consumers' behaviour. Some works suggest that eating habits are not just a biological or nutritional phenomena, but also social, psychological, economic, symbolic, religious, etc.

A key action of the scientific community is to guide healthy policies by interventions from the public administration. One of them should be allowing more efficient public (private) expenditure resources. To avoid undesired policy effects, it is important to simulate possible impacts of, for example, fiscal changes on low income families' consumption. The public policy also deals with incentives for companies that promote healthy behaviour; strengthing the school plans dealing with physical activities, nutrition and health; drawing high quality in school dinning programs; promoting catering services with healthy menus; and developing public sport facilities (Oliva *et al.*, 2008).

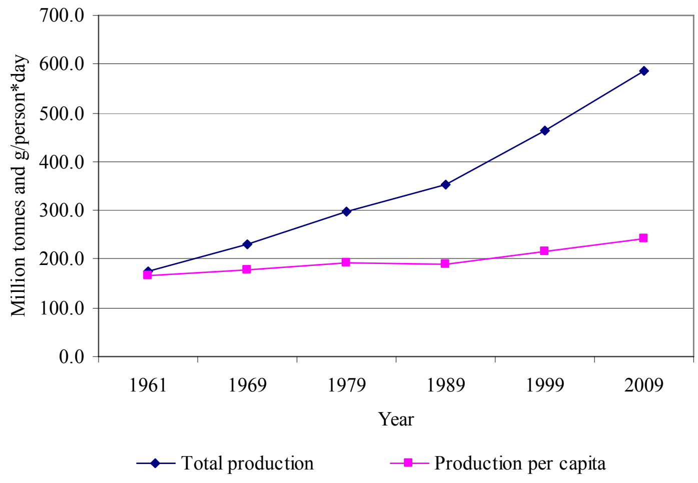
1.3 Fruit and peach production

1.3.1 Fruit and peach production in the world

Fruits may be grown at a wide range of latitudes. They adapt to different wheatear and soils conditions. In 2009, 587.67 million tonnes of fruits were produced in the World, which correspond to 243g/person each day or 85.06kg/person per year (Graphic 1.3). In the last 50 years, total fruit production has grown by 235.7% whereas the production per capita only has increased 46.93%.

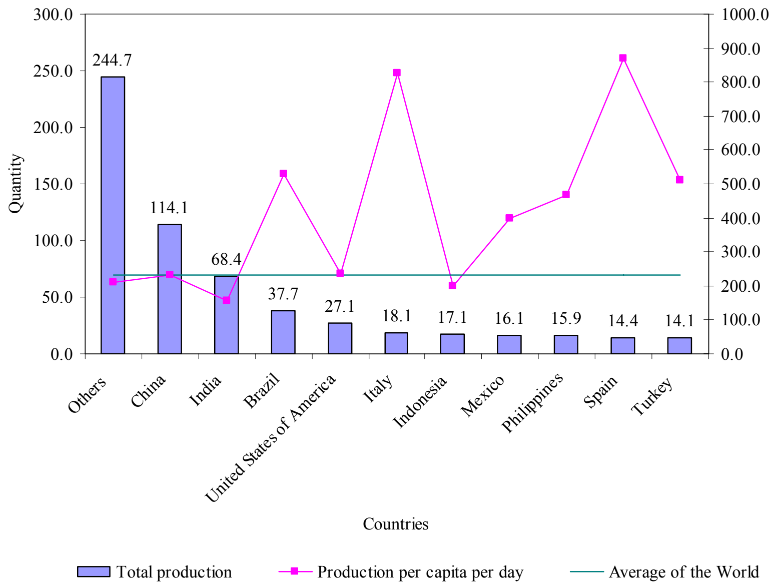
The largest fruit producer is China (Graphic 1.4). This country produced 114.1 million tonnes in 2009, 19.4% of the total world production. India occupied the second position, with 68.4 million tonnes and Spain was the 9th largest producer (14.4 million tonnes). The ten main producers reached 58.4% of the total, but they had 53.5% of the total population. Fruit production per capita of China is 0.9% below the global average and for USA is 0.4% over this average. Although India and Indonesian have large fruit production, their production per capita were 33.8% and 13.8% below the average, respectively. While Brazil produced 528.4g of fruits per capita in 2009 (or 126.7% over the average), in the same period, Italy produced 826.2g (254.5% higher than the mean) per capita and Spain 869.0g (or 272.9% higher than the mean).

Graphic 1.3 Evolution of fruit production in the World between 1961 and 2009



Source: FAO (2010)

Graphic 1.4 Main fruit producers in the world in 2009

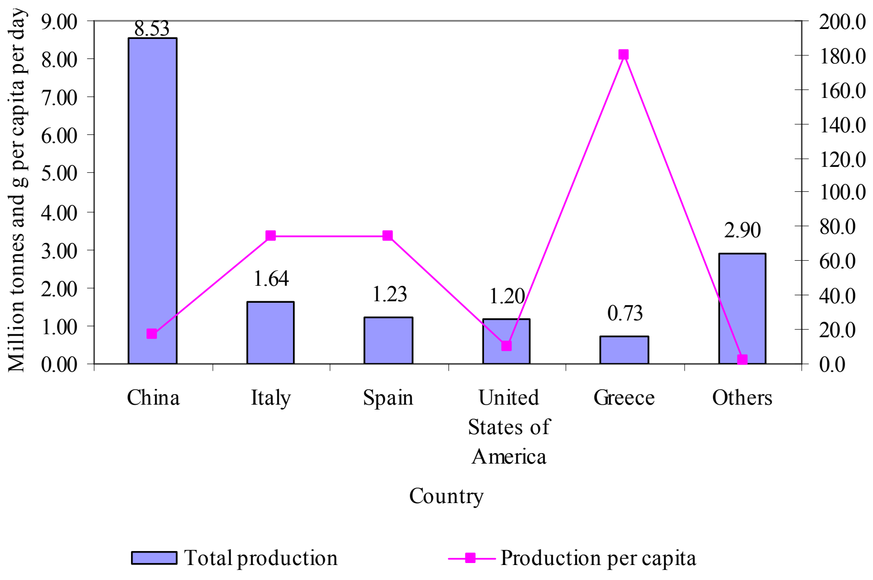


Source: FAO (2010)

Global production of peaches and nectarines was 16.2 million tonnes in 2009, with it corresponds to produce 2.3kg per capita or 6.4g per capita per day of peaches and nectarine, respectively (Graphic 1.5). From this amount, China produced 8.53 million tonnes (52.6% of global production) of peaches and nectarines and it was followed by Italy with 1.64 million tonnes (10.1% of global production) and Spain with 1.23 million tonnes (7.55%). Among the listed countries, Greece had the highest per capita peaches and nectarines production (180g per day) and it was followed by Italy and Spain, which had similar per capita production of around 75g per day. China produced 17.3g of peaches and nectarines per day per capita, USA produced 10.3g and the rest of the countries produced 1.6g.

Although Greece had a great production of peaches per capita, most part was consumed in the own country. In 2008, exports in the world amonsed to 1,510.4 thousand tonnes of peaches and nectarines (Graphic 1.6 b). Spain was the largest exporter with 547 thousand tonnes (36.2%) of peaches and nectarines while Greece took the 5th position with 102.3 thousand tonnes (6.8%). Italy was also an important exporter with 21.6% of total world exports. Chile, in the Southern Hemisphere, produces peaches and nectarines when they are not available in the Northern Hemisphere, and took the 4th position.

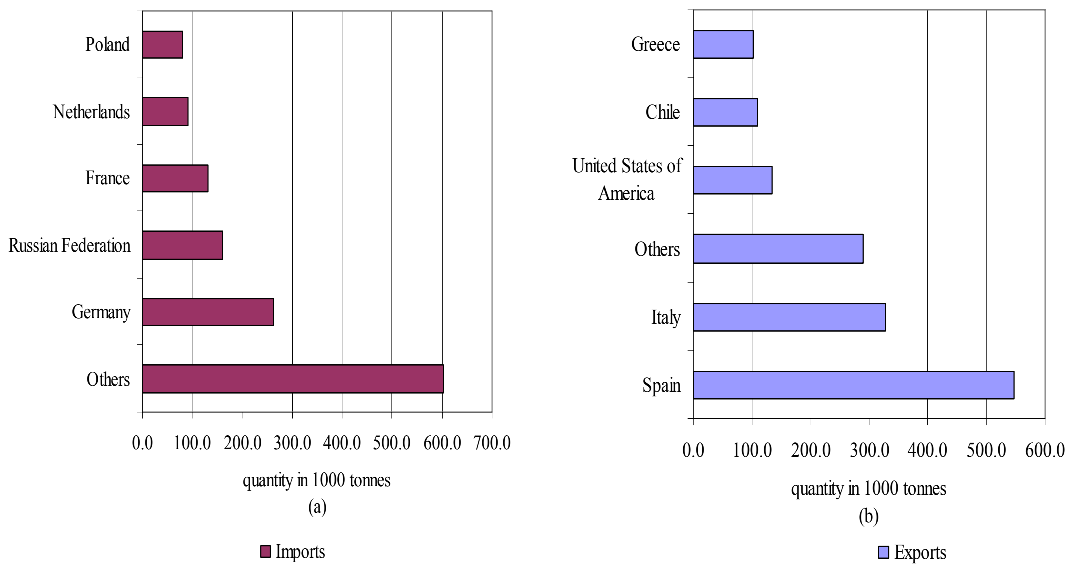
Graphic 1.5 Main peach and nectarine producers in the world in 2009



Source: FAO (2010)

Spain has Italy and Greece as the main competitors in the peaches and nectarines market, because they belong to the European Union (EU) and they allocate their exports in the EU. Graphic 1.6.a shows that the main global importers are the European countries and some of them, such as Germany, imported 262.6 thousands tonnes of peaches and nectarines in 2008. France is a large peach and nectarine producer and it exported 51.5 thousand tonnes that year, however, its internal market is also big and it imports 153.7% of its exports, in quantity. The same thing happens with China, because imports overcome exports in 20.2%.

Graphic 1.6 Main peach and nectarine importers and exporters



Source: FAO (2010)

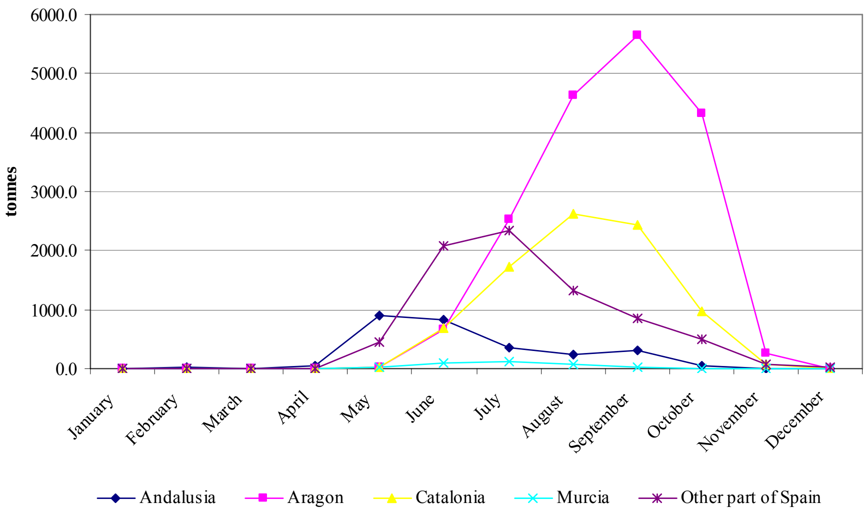
1.3.2 The Fruit production in Spain

The cultivated area in Spain was 50.54 million hectares in 2010. From this amount, 2.36 million hectares (4.67%) was dedicated to produce fruits. Grapevines production occupied 1.02 million hectares (43.26% of the fruit production area) followed by almonds with 578.0 thousand hectares, oranges with 157.6 thousand hectares (24.47%) and peaches and nectarines with 75.5 thousand hectares (3.2%) (MMAMRM, 2010a).

Catalonia is the largest producer region of peaches and nectarines in Spain. Their production area was 19,933ha (26.4%) in 2010. Murcia and Aragon had practically the same area with 16,989ha (22.5%) and 16,966ha (22.5%), respectively. Andalucia is the fourth largest producer with 10.1% of the total peach and nectarine production area (MMAMRM, 2010a).

Peaches offer is different among production areas in Spain. Graphic 1.7 shows the average entrance of peaches in Mercamadrid, which is one of the main wholeseler fruit trade centre in Spain, between January 2002 to December 2007 (Mercamadrid, 2009). In this period, Murcia only sold 0.9% while Aragon commercialized 48.5% and Catalonia 22.9% of total traded peaches. In the graphic 1.7 it is also evident that to see that the Southern areas, such as Andalusia, the peach production pick is in May/July. In the north part of Spain, such as Catalonia and Aragon, the pick is between middle of August and September. Thus, the two greatest Spanish producing areas compete for the national market in similar periods.

Graphic 1.7 Monthly average entering of peaches in Mercamadrid according to the origin between 2002 and 2007



Source: Mercamadrid (2009)

According to FEPEX (2010), in 2009, Spain imported 1.044 million tonnes of fruits with a cost of almost 849.8 million Euros (0.81€/kg) and exported 5.520 million tonnes of fruits with a cost of 4,574.3 million Euros (0.83€/kg). Apples were the greatest imported, with 18.36% of total quantity and 16.3% of total value. In quantity, bananas were the second most import, 17.9% of total quantity, and third in value (12.0%); kiwis took the third position of imported quantity (13.4%) and second in value (15.0%). That year, 5.65 thousand tonnes of nectarines were imported (0.5%) and 5.02 thousand tonnes of peaches (0.5%) with average prices of 0.84€/kg and 0.87€/kg, respectively.

Since 1986 until 2008, exports of peaches and nectarine increased 13.7 times while the imports increased 8.3 times. In 1986, exports of peaches and nectarines were 23.9 times of imports and this relation was 39.4% in 2008. In 2008, 33.8% of peaches and nectarines were imported from Chile, with an average price (the original prices were published in dollars and for this analysis values were transformed to Euros based on exchanges from Banco de España (BE, 2010)) of 1.00€/kg. That year, Spain imported from France 18.3% of its peaches and nectarines with an average price of 0.44€/kg. This difference on average price may be explained by the different time which are offered in the production season. France sells peaches in Spain when the Spanish national market has the greatest offer and consequently lowest prices, while Chile sells them when there is not offer of national production and prices are highest.

Spain exported 5.520 million tonnes of fruits in 2009 (FEPEX, 2010), which was 5.29 times its imports. Both, peaches and nectarines accounted for 50.5% of total fruit exports. Lemons and water melons took the 3rd and 4th position of exports whereas nectarines and peaches took the 6th and 7th positions, respectively. The exports of nectarines accounted for 6.3% of total exports and they were exported with an average price of 0.88€/kg and peaches were 4.2% of total fruit exports and its average price was 0.82€/kg.

The main destinations of Spanish exports, in quantity, of peaches and nectarines in 2008 were France (19.0%), Germany (18.7%), Poland (10.0%), Italy (9.2%) and UK (7.8%), with respective average prices of: 0.89€/kg, 0.88€/kg, 0.68€/kg. 0.91€/kg and 0.93€/kg (FAO, 2010).

1.3.3 Crop and fruit production in Aragon

Aragon has a low and unbalanced demography. It has 47.700 km^2, which corresponds to 9.4% of the Spanish territory and there were more that 1.3 million people in 2009, which was only 2.9% of total Spanish population. The agricultural area accounted for 85.2% (100.00% - 14.79% - table 1.2) of the total area of Aragon and, as a result of an intense migration in the XX century, only 16.9% of its population live in rural areas. While the national average age was 40.8 years old, in Aragón it was 42.9 (IEA, 2010).

The fallow area in 2010 was 464.141ha (9.73% of total area) and forests surface had the highest proportion (42.28%) of the productive area in Aragon (Table 1.2). Cereal area was the second most extensive and it occupied 855,184ha (17.93%). Other fruits, such as apples, pears, fig trees, peaches, nectarines, etc., had 139,582ha (2.93%). Irrigated area occupied 380,736ha.

Table 1.2 Land distributions in Aragon in 2010

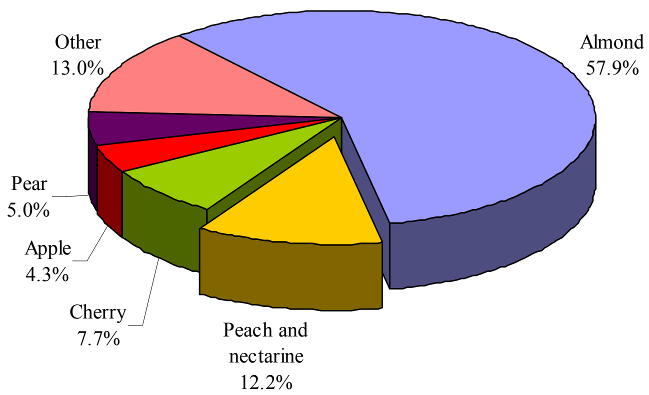
Land distribution	Production system (ha)			Total	
	Dry	Irrigation	Greenhouse	(ha)	(%)
Cereals	666,367.2	188,817.5	0.0	855,184.7	17.93%
Legumes	46,626.1	1,563.3	0.0	48,189.4	1.01%
Tubers	19.2	482.0	0.0	501.2	0.01%
Industrials crops	8,838.6	3,390.1	0.0	12,228.7	0.26%
Forage	54,045.0	98,413.2	0.0	152,458.3	3.20%
Vegetable and flowers	70.8	6,209.5	94.1	6,374.5	0.13%
Fallow	455,601.9	8,539.7	0.0	464,141.6	9.73%
Other fruits	97,022.1	42,560.4	0.0	139,582.5	2.93%
Grapes	30,461.6	10,448.8	0.0	40,910.4	0.86%
Olive	48,623.3	11,247.3	0.0	59,870.6	1.26%
Nurseries	214.8	587.0	128.0	929.8	0.02%
Familiar orchard	404.2	5,142.3	6.1	5,552.5	0.12%
Grassland	262,058.1	122.7	0.0	262,180.8	5.50%
Forest	2,013,399.0	3,212.7	0.0	2,016,611.7	42.28%
Other areas	705,316.5	0.0	0.0	705,316.5	14.79%
Total (ha)	4,389,068.5	380,736.5	228.2	4,770,033.2	100.00%
Total (%)	92.013	7.982	0.005	100.000	-

Source: MMAMRM (2010c)

Almonds occupied 57.9% of the total area of the other fruits. Peaches and nectarines were the second and they had 12.2% (16,966ha) of other fruits area. Great part of cherries (5,762ha) was produced on dry lands and the rest (4,947ha) was produced on irrigation systems. Peaches and nectarines were produced mostly with irrigation systems (96.7%). The irrigation system influences the fruit quality because trees with irrigation produce fruits with larger sizes but with lower concentration of sugar and sugar is linked to taste.

The number of farms is decreasing in Aragon. In 2003 there were around 55 thousand and it went to around 50 thousand in 2005. As a consequence, farms size increased. In the beginning their average size was 44ha and they grew to 49ha. This variation may be considered as an evidence that familiar farms, with small size, are getting less competitive and they are not economically viable. In 2008, the Gross Internal Product (GDP) in Aragon was 23,874 Euros per capita, and the average GDP of agricultural was only 4% of the total GDP (IAEST, 2010).

Graphic 1.8 Other fruits production area in Aragon in 2010



Source: MMAMRM (2010c)

1.3.3.1 PDO Calanda peaches production

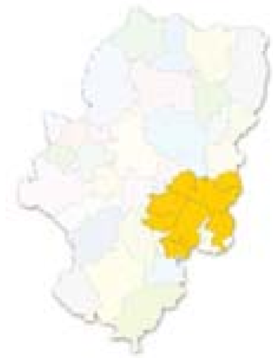
In 1999 it was created the Regulatory Council (RC) of PDO Calanda Peaches with the aim of maintaining the control of peaches produced in the Calanda area, which covers part of Teruel and Zaragoza provinces. In addition to the fruit characteristics, the high quality of the product is the result of special cultivation techniques, such as the manual bagging of fruit. The control of the entire production process, from the field to the consumer, ensures that the peach achieves high quality.

1.A) Current situation of PDO Calanda peaches

The PDO Calanda peaches cultivation area extends along the northeast of Teruel province and the southeaster of Zaragoza province, in 45 municipalities (the complete list is in Table A.6.1 – Appendix 6). Figure 1.1 shows the map of Aragon and the strong yellow coloured area defines where production is allowed. The main producers of PDO Calanda peaches are the municipalities of Calanda, Puigmoreno and Mazaleón, in the Teruel province, and Caspe, Maella and Chiprana, in the Zaragoza province (Barbacil, 2004).

Around 70% of the cultivated areas are family farms, measuring between 1 and 2 hectares. Plots areas are smaller than 1 hectare and have irrigation systems while other crops, such as olive and almond trees, are established on dry areas.

Figure 1.1 Map of allowed area for PDO Calanda peaches production



Source: CRDOMC (2009)

1.B) Cultivation techniques of PDO Calanda peaches

PDO Calanda peaches cultivation demands a lot of labour force and resources. The soil maintenance is performed by adding organic fertilizer during the winter and with few mechanical operations. Nitrogen applications are allowed up to a maximum of 60 days before harvest.

In order to obtain high quality fruits, farmers pay great attention to the crop health care. With exception of the Mediterranean Fruit Fly (*Ceratitis capitata*) that requires special treatments, spraying the crop from 7 to 9 times per year is enough to maintain pathogens at acceptable levels. If the fruits are individually protected with bags of paraffin (Figure 1.2) from the beginning of development stage (June / July), the fly problem is diminished. Bags also protect fruits against rain moisture, help to reach uniform ripening, minimize fruit drop and avoid the direct contact of pesticides.

Figure 1.2 Worker putting a bag of paraffin in a peach

Source: CRDOMC (2009)

Farmers perform the “aclareo” before protecting the fruits with bags. The operation of “aclareo” involves removing the fruits manually. After the esporga, which corresponds to the physiological drop of fruits, farmers remove between 60 to 70% of the peaches, letting them approximately at a distance of 20cm. The aim of this operation is to allocate greater amounts of the plant for the growing of the fruit, in order to get a greater proportion of peaches of large size.

The operations of protecting fruits with bags and making the “aclareo” both consume around 50% of the total workforce during the productive process which corresponds to 25% of the production cost. A person is able to collect 3.000 peaches per day (8 hours). For a production of 15 tons per hectare and considering and average weight of 250g/fruit, at least it demands 60 thousand bags and 160 hours (20 days) of work per hectare. Considering that the cost of the bags is 1.25€/100 fruits and the labour cost is 8.63€/hour (INE, 2010a), thus the process of bag protection has a cost of around 0.14€/kg

1.C) Costs of PDO Calanda peaches

In addition to the associated production costs and management costs to produce a product with higher quality, growers as well as enterprises registered in the

Regulatory Council of PDO Calanda peaches have to pay some fees to help Regulatory Council's activities.

Farms holders, registrated in the Regulatory Council, pay according to their productive area which includes surfaces with trees older than two years old. And registrated companies, such as cooperatives who trade the product, pay according to the productive area of its partners or suppliers and the fees are described in the Regulatory Council regulations (BOA, 2009). It has not been found any study that details the costs of producing peaches with PDO Calanda.

1.4 The thesis structure

The thesis is divided in 8 chapters. The first chapter deals with the introduction about the subject and it presents the main and specific objectives. The second chapter analyses the quality parameters of PDO Calanda peaches and late season peaches and justifies the selection of the quality variables or parameters. The third chapter describes the surveys according to consumers' socio-demographic characteristics with comparisons between their characteristics and attitudes toward PDO Calanda peaches. The fourth chapter estimates the relative importance of a set of the most important attributes of PDO Calanda peaches. The relative importance of attributes is compared with consumers' profiles and market segments are also estimated. Later, the marginal utilities are estimated for levels of attributes of late season peaches. In this part, several models are compared and estimations are made at sample and individual levels. For better understanding, the estimations at sample levels are displayed in chapter 5 and estimations at individual levels are in chapter 6. The seventh chapter deals with the measurement of attributes importance as well as marginal utilities of levels of attributes at same scale. As in other chapters, homogeneous and heterogeneous preferences were taken into account. The heterogeneity was studied with mixed and interaction models. The last chapter, the eighth chapter, summarizes the work and it presents the general conclusions and recommendations for future studies.

Chapter 2: Selection of peaches attributes and levels

2.1 Introduction

The demand for fruit is, in most countries, below recommended levels by official health agencies, whilst there is at the same time a production surplus in the market. More and better knowledge about peaches consumers' behaviour will help growers and traders to develop better products.

The purpose of this chapter is to understand the most important aspects that define peaches quality and consumers' perceptions about their quality as well as motivations that determine their purchasing decisions and consumption. This analysis should provide information about the aspects more interesting to incorporate in a questionnaire designed to deal with PDO Calanda peaches and consumers' behaviour.

In this chapter, first there is a literature review dealing with quality evaluation and more specifically related to fruits, peaches and PDO Calanda peaches. The following section deals with results from a Focus Group to discuss with PDO Calanda peaches quality attributes. The next section gathers observations from a group of managers responsible of fruit and vegetable at several retail chains. Information about prices and quality characteristics of yellow peaches in the market is gathered in the next section. Finally, the selection of attributes and levels for the consumers' choice experiment are explained.

2.2 Relationships between quality, purchase and consumption

The aim of this section is to find out attributes that affect quality perception, purchasing and consumption of peaches with special attention to those with Protected Designation of Origin (PDO) Calanda. First of all, food quality has to be clarified and it should be differentiated between objective and subjective quality aspects.

Objective quality is usually evaluated during the production process and it is based on parameters that are measured objectively. Objective quality refers to products, processes and controls. Specific controls are important aspects because they measure the quality dispersion of products and processes, i.e., it is the quality guaranty. For example, product quality can be determined either by the fruit size, sugar content or colour; process quality is related to the production system whether it is, for example, organic, aiming to achieve of socio-economic workers' advantages or pesticides free; quality control is concerned with colour, flavour and homogeneity.

Subjective quality refers to consumers' perceived product quality and it is linked to final payment. It is not advisable to increase product quality without increasing the perceived quality because it might not be accompanied by a greater consumers' willingness to pay. It partially explains why companies make a great effort to communicate their products' innovations to consumers and to increase their awareness.

There are many ways to address subjective quality in the social sciences but the most common is to undertake hierarchical and multidimensional approaches. In the hierarchical approach, consumers' quality perception is associated with product's characteristics (attributes) and consumers' own personal values. In the multidimensional approach, the perceived quality is the combination of a number of product's characteristics.

In the multidimensional approach, characteristics can also be classified into intrinsic and extrinsic attributes. Intrinsic attributes are those able to be measured by their physical characteristics, while extrinsic attributes are all the rest. For example, peach size and its colour are intrinsic attributes because they refer to physical aspects, while price or brand are extrinsic attributes because they can be changed and the product is physically still the same.

Grunert (1995) makes a good integration of multidimensional and hierarchical approaches to understand food quality with the Total Food Quality Model. Consumers take purchase decisions based on their previous experiences and on food quality expectations. Food quality expectations result from available information (quality cues). It is considered that available information is not perfectly transferred to consumers and it is affected by purchase situations.

Consumers experience food quality after purchasing food products. Experience quality includes, among others factors, sensory experiences and meal preparations. The relationship between food expected and experienced quality determines consumers' satisfaction. If expectation quality is higher than experienced (observed) quality, the impact on consumer satisfaction is negative. There is a positive relationship between consumer satisfaction resulting from food quality and the likelihood of buying this kind of food. In this model, purchasing intention is a trade-off between the food quality expectation, its fulfilment and costs (generally assess by money). Usually, quality expectations impact purchase intention positively while costs affect negatively.

2.2.1 Peaches objective quality

2.2.1.1 Peach production

Climatological and production techniques are the main factors affecting production and its corresponding peaches' quality. Once the fruit is picked up, as it is a perishable product, there is a great effort to maintain its quality.

According to Heiman *et al.* (2002) farmers, retailers and consumers have different perceptions about peach quality. Farmers value peaches varieties by its productivity and resistance to treatments with pesticides, retailers prefer products lasting for long and with good appearance (i.e., long shelf life, fruit size and colour), while consumers would rather prefer fruits with higher internal quality, for example with better taste and free of pesticides, but they also take into consideration external attributes. When there is a short supply, attributes that are important for farmers, such as productivity, gain in importance, while when there is a production surplus attributes considered important by consumers have a higher priority. Aspects important to consumers are addressed in this work, but trying not to lose sight of other aspects more closely related to production.

Consumers value organoleptics features as main factors that determine fruit purchase. Sensory quality of peaches depends on a delicate balance between sugars, acids, phenols and aromatic components, with a number of additional factors, as flesh texture. Consumers' satisfaction for peaches is strongly influenced by their sweet taste (Trevisan *et al.*, 2006), juiciness (Bruhn, 1995), soft texture and aromatic smell (Uva *et al.*, 2004).

According to the Crisosto *et al.* (2003), peach sweetness is related to a minimum amount of sugars - the amount of sugar is measured by Soluble Solids Concentration (SSC), a maximum amount of Titratabe Acid (TA) and the relationship between them – SSC : TA. These amounts and ratios vary among peaches varieties, and when the amount of SSC is low (<10%) the quantity of Titratable Acid (TA) plays an important role on peach sweetness perception (Crisosto *et al.*, 2005). Although acid and sugar amounts are good indicators of taste quality, consumers are not familiarized with these indices.

Crisosto *et al*. (2006) classify 23 peach cultivars according to organoleptic characteristics. They group the cultivars in three sensory groups: sweet, sour and balanced flavour. According to those authors, this system is very useful and would help promoting peaches consumption because consumers could guide their choices according to their sensory preferences. This classification is useful but it might be that the most important bottleneck for peach consumption is at harvest time.

It is essential to collect peaches when they are ripened because it affects their storage and organoleptic quality. Maturity can be treated under different approaches. A fruit is physiologically mature when it is able to continue its development with its own reserves; harvest ripeness is achieved when fruit is apt to bear commercialization operations and ripeness for consumers is reached when peaches have characteristics for immediate consumption.

Peaches are harvested too early due to their short shelf life after harvesting. If fruit is harvested before physiological ripeness, it will not be able to complete its climacteric evolution during storage time. Unripe peaches are more susceptible to wilting problems, internal damage and mechanical damage. On the other hand, overripe fruit, have abnormal texture, they are more susceptible to fungal and lose their flavour and aroma.

Maturity indices to evaluate the optimal time to harvest have been developed to avoid premature harvesting problems. These indices are simple, easy to perform when using some relatively inexpensive equipment to obtain some objective results. Basically, the evaluated parameters are: fruit size, colour of skin, flesh firmness, sugar content, acid content and smell.

Although peach size indicates its development level, it is not a good parameter for ripeness. It is not related to fruit organoleptic quality, while colour of skin and flesh firmness is related with it (Garcia *et al.*, 1999). The colour of the skin is related to the peach variety and ripening stage. Peach varieties have a dominant colour and a background colour. For example, peach variety “Spring Lady” has a deep red colour in 80-90% of the skin and the background is yellow-orange (Catalá *et al.*, 1999), but the red colour does not indicate a peach ripeness degree.

There are three types of pigments on peaches skin that determine their colour. Anthocyanin provides red colour and its synthesis depends on the amont of light that strikes on fruits. Red colour is neither related to flesh firmness nor to ripening stage. Carotenes, which are yellow pigments, are not synthesized by light strikes on fruit skins and they are related to flesh firmness and ripeness. The third pigment, chlorophyll, is related to the strake of light on the fruit and its developing stage. Its degradation is linked to more ripened peaches (Lewallen, 2000). In summary, yellow and green colours are good indicators of ripeness but red is not a good indicator.

In conventional production systems, without use of bags to protect fruits, the sun light strikes on peaches, but effects are different on peaches distributed in the same tree. Fruits located in the bottom of the tree receive less light than those produced at the top, resulting in uneven red coloured peaches (at the top they are more red than those at the bottom) (Lewallen, 2000). The amount of light striking the fruit is the same when peaches are produced with protected bags. In the absence of light, the epidermis with red coloration does not exist and fruits get uniform yellow colour at ripened stages and, probably, it is a reliable quality signal for consumers.

According to Crisosto (2007) flesh firmness is the best indicator for peach ripeness and it is also a good parameter to estimate its shelf life. This author proposes some indices for flesh firmness, based on the Magness–Taylor approach, which is flesh resistance against penetration by a punch of 8mm (0.5cm^2), to determine the best time for peaches commercialization and consumption. According to him, soft peaches are more susceptible to damage and, therefore, he recommends that Californian peaches should be collected at flesh resistance between 26.3 and 35.3N, to prevent damages during handling and transport. Then, as flesh softness indicates maturity, to guarantee organoleptic quality, flesh resistance should be between 8.8 to 13.2N when eating.

Crisosto (2006) suggest a pre-ripening technique to improve peach quality. In this case, fruit should be left during 48 hours after harvest at 20°C and before cooling. Then, fruit would be stored at 0°C. With this system fruits become softer for consumption, internal damages are significantly reduced and the shelf life is increased. In the case of PDO Calanda peaches, DGTA (2001) recommends the introduction of 100ppm of ethylene during 24-48 hours at 20ºC before cooling at 0ºC to increase ripening uniformity.

2.2.1.2 Peach conservation and packaging

Post-harvest techniques are geared to diminish the deterioration of horticultural products in order to maintain quality during a desired time. The success of these techniques is based on fruit quality at harvesting time, which depends on agronomic factors. Factors considered at post-harvest time are: ripening degree, physical damages, temperature, atmospheric composition - closely linked to gases concentration such as ethylene and relative humidity.

Temperature is a fundamental factor to maintain peach conservation. It requires action on two levels of the cold chain: one is pre-cooling and other is the proper temperature control during storage. Pre-cooling is the change from harvest temperature (when fruit is in the field) to a lower temperature. The purpose is to moderate physiological activity (essentially transpiration and respiration) and, thereby, enhancing long standing shelf life.

Refrigeration is a conservation technique that relies on application of certain temperatures, with the minimum variation possible, to keep fruits in good condition. The aim is to stop fruit metabolism and respiration, reducing losses of sugars, vitamins, organic acids, etc., delaying fruit ripening, which allows offering fruits in other periods or transport them over longer distances and reducing the risk of microorganisms development, which would damage the fruit.

The storage time and storage temperature vary according to species and varieties. Freezing temperatures should be prevented for all types of fruits because it causes cells death and tissues physical disruption. The freezing level varies with the type of fruit and sugar content (measured by the amount of SSC), which for peaches is around -0.8ºC.

Peaches suffer chilling injury when stored at temperatures in the range of 2-7ºC, which has been called killing temperature by Crisosto (2007). The symptoms of these injuries can include decolouration, dry texture, poor ripening, flesh vitrescency and lack of flavour and aroma. The susceptibility to damage fruits depends on the variety, fruit harvest earliness, etc. The inadequate implementation of the storage temperature decreases product shelf life; for example, for the variety “Elegant Lady” stored at 5°C has reduced its commercial life from 3 weeks to only 1 week.

The optimum temperature to store peaches is around 0°C (plus or minus 0.5ºC), because in this condition the fruit metabolism is reduced, the rate of microbial activity almost stops and damage from cold or freezing is controlled. According DGTA (2001), because PDO Calanda peaches contain high SSC, they bear well these temperatures and keep an excellent taste, flavour, firm flesh and attractive colour. They are able to maintain these characteristics during 4–5 weeks at storage places. However, shelf life can not be extended indefinitely. For longer storage time, they would suffer an inability to evolve and they would stop ripening.

In addition to temperature, gases concentrations have a great influence on peach maturation and storage. Peach is a climacteric fruit and therefore is sensitive to ethylene effects. Ethylene is a plant hormone that accelerates ripening and its sources can be diverse: from other ripened fruit, combustion of organic products, etc. It is necessary to prevent any ethylene accumulation to protect fruits in storage, so ventilation, chemical and physical removal are undertaken.

Humidity is another factor to take into account during storage. Its effects on peaches are: weight loss (water), abnormal wilting and textures. The wilting is visible on the peach when it has lost 3–5% of initial weight. The air relative humidity is maintained between 90 to 95% to avoid peach dehydration in storage.

The fruit respiratory activity involves the use of oxygen (O_2) around the fruit and the production of carbonic gas (CO_2). Nowadays a new storage technique has been developed to modify the proportions of O_2 and CO_2 in order to stop breathing and decrease the ethylene production, and consequently delaying fruit ripening and the senescence process. This modification technique is known as protective atmosphere and there are two levels of control: controlled atmosphere and modified atmosphere.

It has been observed that the application of a modified atmosphere plus cooling, can better preserve peach quality and extend their marketing period. A very high rate of CO_2 decreases physiological fruit disorders as well it has a fungistatic effect, but it encourages fruit fermentation which changes fruit flavours and taste.

PDO Calanda peaches, according to DGTA (2001), with higher concentration of CO_2 than 10% and lower O_2 concentrations than 2%, decrease fruit quality. When these gases are over those limits, there are acetaldehyde and ethanol accumulation (fermentation) in fruits and they develop strange odours. The best modified atmosphere results for PDO Calanda peaches are observed with two alternatives: the first is when

CO_2 concentration is 5% and O_2 concentration is 10% and, in the second the concentration of CO_2 is 5% and O_2 is 2%. For long storage time, sensory acceptability of peaches treated with those two gas concentrations or treatments are better than canned peaches preserved without modified atmosphere.

2.2.1.3 Specific quality rules of PDO Calanda peaches

Peaches produced in the Calanda area have been traditionally recognized to have excellent fruit qualities (big fruit size, skin straw-yellow coloured, delicious flavour and late production season). A century ago, Ignacio de Asso stated: “everyone recognizes that peaches from Calanda area have prominence on the rest of Spain” (DGTA, 2001, p. 3). To give an idea about the recognition that these peaches had in the past, Barbacil (2004) reports that in 1867 some dried peaches from Calanda were sent to the Paris Universal Exhibition.

The Protected Denomination of Origin (PDO) Calanda was created in response to the request of the Calanda Peach Producers Association, to maintain and increase the product prestige and its differentiated quality, and to guarantee consumers about the fruit quality. It was administratively recognized since the publication of the Order of 25th August, 1999 by the Department of Agriculture from Government of the Aragon (BOA, 1999). This regulation was replaced by the Order of 17th March 2009 of Government of Aragon (BOA, 2009). These Orders specify quality standards for PDO Calanda peaches.

It authorizes exclusively peach varieties known as “Yellow Late Season” and its selected clones (Jesca, Evaisa and Calante) to receive the PDO certification. Fruits must have been produced using the traditional bag protection technique, they have to belong to “extra” or “first” categories and they have to accomplish several features.

The external appearance of fruits must be of entire pieces, healthy (no damaged for some microorganism), clean, no strange visible things, moisture-free, without strange odour and flavour. The accepted colour is between uniform creamy and pale yellow. A small amount of anthocyanin spots or streaks are acceptable, and green or yellow-orange skins indicating, respectively, unripe and overripe, are discarded. The fruit shape should be rounded. The calibre, which corresponds to normal fruits, is very large. Thus, the lowest accepted diameter is 73mm, which corresponds to the category

AA of Regulation (DOUE, 2004) - setting trade rules of peaches and nectarines in the European Union and weighing more than 200grams (in table A.5.1 of Annex 5, is a list of peaches' dimensions). The stone is ovoid and it is small in comparison to the fruit size.

The peach flesh hardness, at harvest, varies in pressure resistance between 3.5 and 5.0kg /0.5cm^2. Sugar content, which is determined by SSC, must be at least 12 degrees Brix.

To maintain the quality of the peaches from the farm to consumption, the regulation determines that, after harvest, fruits must be brought from field to industry protected with bags before packaging. The peach size classification, before packaging, must be by mechanical means, and those peaches that do not have both, the good look and colour required, should be discarded manually. Fruits are packaged in suitable boxes in a single layer.

The entire process has to be performed separately from other types of peaches that are not covered by PDO regulations and they have to be properly identified, in order to be traced all along the production process. When fruits comply with all specifications, the Control Board certifies that the product is authentic and it is allowed to get the PDO recognition and label.

2.2.2 Perceived peaches quality

Perceived quality is subjective and it is the outcome of consumers' assessment. Subjective quality is related to objective quality but also with other factors which do not correspond to product features by themselves, such as purchase situations. In this context, it is meaningful to differentiate between searching, experience and credence attributes.

Search attributes are those that are available at purchase time whereas experience attributes are not. For example, colour is a search attribute. Consumers only value experience attributes when they eat their meals and taste, as an example. Credence attributes are neither available before nor after food purchase and consumers have to feel their benefits in the long term. Meal nutrient contents are credence attributes because consumers believe they benefit their health.

These three kind of attributes are related one each other when consumers perceive food quality. At purchase locations, consumers can estimate characteristics of non available attributes based on one or many available attributes. As it was explained in the section dealing with objective quality, peaches taste (sweetness) is related to the peach variety and its ripeness. Ripeness is a general concept and it corresponds to particular product development stages. Ripeness is related to peach colour and texture. Thus, at purchase location, consumers have expectations about peaches taste quality based on their colour and texture parameters.

Taste is the main feature that explains peaches consumption according to Bruhn (1995) and Babicz-Zielinska (1999). Satisfied consumers with peaches taste are more motivated to repeat consumption. According to Crochon (1985) consumers are willing to pay up to 30% more for those peaches able to guaranty taste quality.

Theories on consumers' behaviour consider that consumers are satisfied when their product quality expectations are satisfied. Problems arise if consumers have high quality expectations, for example for sweet peaches, and their subjective quality does not match their expectations.

Consumers' fruit quality dissatisfaction can be explained in several ways. One is consumers' skills to value fruit quality. In the case of peaches, the red colour of the skin is not related to sweetness, although, according to Uva *et al.* (2004), dealing with New Yorkers' peaches purchase, quality perception of red coloured peaches was related to peaches' sweetness. This misinterpretation of peach quality can induce mistakes and diminish consumer satisfaction.

According to Trevisan *et al.* (2006), appearance is the most important peach attribute. Peaches' appearance is linked with colour, brightness, size, shape, defects and imperfections. Bruhn (1995) concluds that peach colour is more important than size and size is more important than presence of defects.

Peach size influences consumers' quality perceptions. One parameter that consumers consider about peach size is the volume that the stone occupies inside the flesh. Big size peaches have a higher relation between flesh and stone, so it provides more benefits to consumers. Other aspect is the number of peaches that a consumers should eat to alleviate hunger. As the number increases when peaches are small, it would also require a greater effort if consumers have to peel the skin off (Kays, 1998).

The peach industry has developed new varieties with good appearance that accommodate their production systems and their improvement, but not worried with peaches' taste (Crisosto *et al.*, 2003; Crisosto *et al.*, 2005). In the short term, an attractive appearance can improve peaches selling, however, in a long term, if another quality characteristic is not achieved a consumer rejection could happen. According to those authors' opinions, it is necessary to develop peaches' varieties and production systems (especially for harvesting peaches with optimal ripeness) with good balance between appearance and organoleptic qualities (taste and smell).

Normally, quality variability among fruits is high and consumers need to select those with best quality. Sometimes visual references are considered not enough and consumers use other references as peach texture, which is evaluated by touching them. For example, consumers can evaluate if peaches have lost water in their conservation (there would have a lack of freshness) or if they are internally injured or even if they are ripened. Peck and Childers (2000) study the relationship between consumers' desire to touch peaches at purchasing time and their buying impulse. They find that those consumers who have higher desire to touch have higher probability to buy peaches compulsively. Those consumers who consider touching important may limit some commercialization practices of fresh fruit, such as packing peaches in trays or baskets.

Leisure time spending has increasingly become scarce as a result of social changes, especially for women working outside home. For this reason, convenience products are becoming more demanded. Wales (2009) affirms that desirability of fruits and vegetables consumption can be assessed based on two dimensions, time and effort, and in many steps. The steps referred by him are: planning the purchase, preparation of food, lunchtime and provision/management of fruit.

The benefits acquired by more convenient fruit would be essentially lower purchase frequency, less complex planning of what to buy (which gives rise to more spontaneous decisions), self-service encouragement (spending less time and energy at purchasing), new sales channels would be feasible (such as Internet), more consistent product quality (it would facilitate purchase choices), prepared to eat in any situation (product ready to eat because it does not need to be peeled) and consumers not requiring a high knowledge about storage (special packing that allows longer storage time results in less waste of food at home).

Brand is a search attribute and may influence consumers' choice decisions although sometimes it might work as a credence attribute. In Europe, there are many food brands that inform where the food is produced. Quality differentiation linked to food geographical origins results in product authenticity and it usually provides more information about production development and food preparation.

Brand is defined as the name, term, sign, symbol or design that seeks to identify a product and differentiate it from others. It creates an information flow to consumers providing them the capacity to summarize the product quality. Brand differentiation happens when it incorporates image benefits. Collective brands are alternatives to single brands, especially in the case of small businesses, which individually would not be able to implement their own brand. Protected Designations of Origin (PDO) can be considered as part of the quality differentiation based on collective brands, as they have an image and meaning that identify those products.

Van Ittersum and Wong (2010) identify segments of consumers that have directly or indirectly quality perceptions of olive oils with PDO. Direct quality perception means that consumers know the product quality by itself although indirect perception of quality is estimated by the image of the production area. Consumers who live close to the production area have a higher direct perception of product quality while others perceive quality indirectly. It means that it is expected that consumers from Zaragoza should have better quality perception of PDO Calanda peaches than, for example, those from Barcelona or Madrid.

According to Van Ittersum *et al.* (2007), other function of PDO brands, is to increase the product value, by providing food security (reduces risk in the purchase decision), reference (known supplier), customization (close relationship between the product and consumer) and socialization (mechanism of expressing values). It is supported by Van Ittersum and Wong (2010) that consumers believe eating local produce with PDO is a good way to protect their economies and local culture against cultural convergence due to globalization processes.

The quality control is another advantage of fruits with PDO. Normally, as a consequence of low quality control, fruits have low homogeneity and its purchase takes a risk of not reaching a quality threshold but fruits with PDO usually have higher prices showing greater homogeneity. Karagianni *et al.* (2003) find that Greek consumers' quality perceptions towards an apple with PDO are higher than others and they feel they are safer to buy than without PDO. A positive perceived quality corresponds with a higher willingness to pay, in particular for those consumers who do not have a good knowledge about apples quality.

In Aragon, several studies on consumer behaviour of food with Protected Designation of Origin (PDO) have been carried out. Espejel *et al.* (2007a) study the case of olive oil, Espejel *et al.* (2007b), Cilla *et al.* (2006), Resano *et al.* (2007 and 2009) consider the case of cured ham and Mtimet and Albisu (2006) and Mtimet (2006) of wine. In all cases, the product image towards the designation of origin is favourable and their degrees of quality differentiation are estimated as sufficient to increase consumers' willingness to pay. Meanwhile, according to Sanjuán *et al.* (2009) saffron from Jiloca with PDO does not have enough differentiation degree to increase consumers' willingness to pay. Based on these previous works it is expected that consumers of PDO Calanda peaches appreciate products from Aragon since its quality is high enough to differentiate them from other peaches.

Fruits and vegetables have a healthy food image which is associated with good quality of life. Their nutritional contents increase health and they help to avoid cardiovascular problems. These benefits can not be checked at purchase time or immediately after consumption, but only in the long term. Thus, fruits benefits are considered as credence attributes.

2.2.2.1 Fruit consumption determinants and socio-demographic characteristics

Peaches are fruits low in calories, reasonable content of vitamin C, plenty of fiber and good contribution of carotene. Its related health benefits affect skin and muscles, have a mild laxative effect (Illescas and Bacho, 2006) and have antioxidant effects (Canfrán, 2007). Although peaches have positive healthy effects, their consumption may be more conditioned by habits, attitudes, subjective norms and social influences.

Brug *et al.* (2006) attempt to predict fruit consumption by the Planned Behaviour Theory (PBT) and personal experiences on fruits and vegetables consumption at the time of childhood, as they appear to determine personal likes and preferences. Briz *et al.* (2007) find that people who have being forced to eat fruit in their childhood are less likely to be regular consumers of fruit when they are adults.

Cultural habits determine also food consumption. In Spain, although people eat fruit at any time, the major occasions are at lunch and dinner; when they are normally taken for dessert (Herrero-Velasco, 2005). Fruits are the main dessert, as reported by 97% of Spaniards, followed by dairy products (71%), ice cream (17%) and sweets (7%). Dairy products are most usually eating at breakfast, while ice cream and sweets are consumed outside meal times.

Age is an important variable to explain fruit consumption. Fruits are a favourite dessert for people older than 46 years, while people who are between 26 and 35 years eat more dairy products and youngsters, aged between 16 and 25, prefer more ice-cream and candy. Herrero-Velasco (2005) explains that low fruit consumption among young people is a consequence of their lifestyles, with greater freedom for their eating schedules. Often, they skip one of the three main meals, i.e., sometimes young people exclude some occasions to eat fruits, as during desserts.

The employment situation also influences fruit consumption. Unemployed and retired people spend more time at home and they have normally three main meals a day, and they take desserts, so they consume significantly more fruit than a person who works full time outside home.

Another habit in Spain, which is different from many other European countries, is the food consumption timing. The main meal is around 14:00 and, at work, few people bring food from their home. Herrero-Velasco (2005) mentions that as women bring hand bags, sometimes they take a piece of fruit to eat at work place.

Fruit convenience determines its consumption. According to Iglesias, cited by Canfrán (2007), peaches have lost significant market share for nectarines because peaches' skin is fuzzy while nectarines are easier to eat. Briz *et al.* (2007) argues that the consumption barrier for peaches is its skin and that people eat fruits that need to be peeled by knife at home. The most convenient fruits are those who do not need to be peeled and they can be eaten at any situation and anywhere.

Per capita in take of fruits and vegetables in Spain is also conditioned by town size and household characteristics, such as, family size, socioeconomic status, presence of children, age and employment status of the person who goes shopping. In towns smaller than 2,000 people and larger than 100,000 people have higher fruit consumption than the average national consumption. There is higher fruit and vegetable consumption in those households with only 1 or 2 adults, and in those with children, especially younger than 6 years old, values decrease significantly (Herrero-Velasco, 2005).

Family income is positively related to consumption of fruits and vegetables (Herrero-Velasco, 2005). He *et al.* (1995) observe in American homes that fruit prices and family income affect the likelihood of buying fruit and, consequently, fruit eating. Jones (2006) find that low income families in the U.S. have higher consumption elasticity than rich families. In Portugal, peaches demand has higher prices elasticity than pears, apples, oranges, strawberries and plums (Tiffin and Aguiar, 1995).

More and more consumers are becoming aware of environmental problems caused by human activities. This shift provides an incentive for companies which try to incorporate environmental friendly process on their productive activities and on their marketing strategies. Friendly products are those that are less toxic and pollute less the environment than other products.

In Spain, fruit and vegetable consumption produced by friendly means is still small in comparison to total domestic production. In general, attitudes towards this kind of products are positive, but a smaller percentage of people are willing to pay a premium price for this type product. There is a consumer segment, which is more familiarized with organic foods, differentiating friendly products from others. The price is pointed as the main reason for low penetration of friendly products, mainly for low income families (Ruiz *et al.*, 2001).

2.2.3 Focus Group with consumers of PDO Calanda peaches

Focus Group (FG) is a qualitative method used to obtain primary data on individual experiences, perceptions, beliefs and meanings about particular topics or issues. The application of this method has been very wide, varying from health studies: attitudes, beliefs, and the best means of communication on certain diseases (Friedman and Shepeard, 2007), knowing tastes to develop prevention programs more effectively (Heimann-Ratain *et al.*, 2007); the environment: assessment of organic production system (Padel, 2008), utilization and conservation of bio-diversity (Achieng *et al.*, 2009) and in marketing; understanding factors that determine healthy food choices and price strategies behaviour at purchase (Waterlander *et al.*, 2010), determining the degree of importance that consumers attach to sensory characteristics of Mungbean (Galvez and Resurreccion, 2007), acceptability of new technologies for processing meat (de Barcellos *et al.*, 2010), identify motivations and barriers on fruit consumption (Sabbe *et al.*, 2009) and attitude and purchase behaviour of peaches (Uva *et al.*, 2004).

There are three crucial research stages in Focus Groups. The first one is how to choose participants, the next one is the group session and the last one is the data interpretation. In our case, participants were invited to participate in the Focus Group if they declared, before the session; that they were regular consumers of PDO Calanda peaches. This criterion was applied because it was expected that they had a reasonable knowledge about the product so they could give insights.

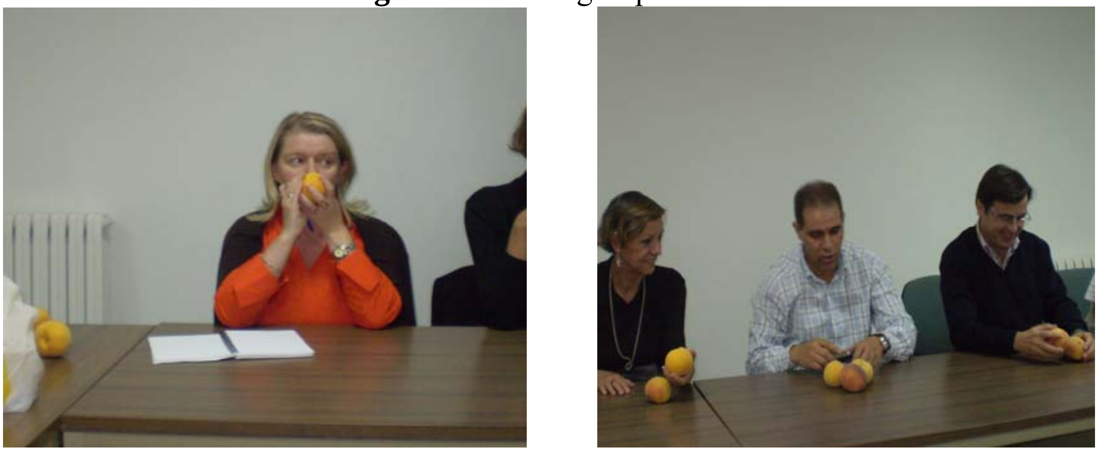
In a Focus Group session is important that participants have opportunities to express their points of view and to maintain the informal nature of the meeting as suggested by Sim (1998). The Focus Group session was attended by 9 people with similar profile. All belonged to a similar social classe and academic training, and their ages ranged between 40 and 55 years old. Another common feature is that all participants were working at IAMZ (Mediterranean Agronomic Institute of Zaragoza) (Figure 2.1).

The session was carried out at the IAMZ and the aim was to clarify the reasons who lead consumers purchasing decisions on PDO Calanda peaches and to determine which characteristics consumers attach more importance when they buy those fruits.

The role of the moderator and how data are collected are two key elements. The moderator's behaviour may inhibit participation or even determine participants' responses. Therefore, at the beginning of the session, the moderators (there were one moderator to guide the section and other to register the information) made clear that their wish was to learn about their behaviour, there were not correct answers, and the main aim was to know their personal opinions and attitudes towards PDO Calanda peaches. They also made a comment that probably personal opinions were different, but it was very important to know their different thoughts.

The session was divided in two parts. One consisted of listening the conversation among participants on issues raised by the moderator and the second part consisted in evaluating several peaches of different characteristic.

Figure 2.1 Focus group session



One of the first questions was about the main features of PDO Calanda peaches that they valued most. The answers were unanimous and everybody agreed that the smell and taste were the two most important attributes. Participants stressed that there was a lack of smell when they bought other peaches and that PDO Calanda peaches had an intense aroma. With regard taste, they made comments that the sweetness and juiciness were always present on PDO Calanda peaches and, therefore, they had never been disappointed about their quality.

In addition, flavour and fruit size were also key characteristics. Large size peaches was an important part of their image. A great proportion of participants were attracted by large peaches while some of them thought that PDO Calanda peaches were too big to be eaten individually at once. Mainly men were more prone to accept large peaches and they thought that, with just one large piece, it would be sufficient to satisfy them. Some women, who were teenage mothers, expressed that their daughters were not able to eat a single piece and, ultimately, had to share the fruit. Nobody liked the idea of sharing peaches with other persons.

The production period for PDO Calanda peaches is another part of their image. All participants knew that this kind of peaches is offered at the end of the peach production season (it is a typical summer fruit) as they are available from September until end of October. According to their perceptions, the best peaches were produced in this period because they have more time to increases their size and to accumulate more sugars.

The next issue was to compare opinions about peaches produced in Calanda area with and without PDO conditions. The general opinion was that peaches from the Calanda area, even without PDO, have higher quality than peaches from other places. For some attendants, peaches produced in the Calanda area without PDO could be comparable to those with PDO, but they also recognized that PDO ensures the quality. According to them, sometimes they bought peaches from Calanda without PDO and their quality did not accomplish their expectations. The quality controls carried out by the Regulatory Council of PDO Calanda are considered sufficient to ensure the quality of the product and the quality warranty has been the main factor to justify a premium price by consumers.

Participants also pointed that peaches with PDO had higher prices in the market than other peaches. They mentioned that this difference could vary from 30 to 80% and some of them suggested that prices of peaches with PDO could be between 2.50 and 3.50€/kg and other thought that they should be from 3.5 to 4.0€/kg. The smallest price difference appears to be closer to results obtained by Polo (2007) and Polo and Albisu (2010), as they find that 40% of wholesalers who marketed this product claimed that the premium price of peaches with PDO was 20% higher than those from the Calanda area but without PDO.

In the second part of the session, some peaches were shown to participants. Some of them had the PDO label and others not. Participants were asked to identify which ones had PDO. The purpose was to have comments about peach quality that consumers used to link with the original product, i.e., if there were some aspects of PDO Calanda peaches quality that could distinguish them from other peaches.

The first sample was of PDO Calanda peaches and they were arranged in a plastic tray with 4 units (Figure 2.2). The fruits had uniform size and colour. They were yellow coloured and seemed to be ready to eat. Their sizes were the smallest allowed by the PDO Calanda Regulatory Council (diameter about 73mm).

When the first sample was shown, it generated many doubts about its origin and conclusions were discouraging. The fruit size was the main doubt because consumers had the idea that PDO Calanda peaches were of big size. However, some participants made a comment that peaches with that size, neither not very small nor very large, would be perfect for them. Odour was identified as aromatic and, therefore it would expect to have a good taste, it was the main factor that reinforced the idea that the sample was composed of authentic products (Figure 2.1 shows this part of session). Attendants estimated that price of those peaches was between 2.50€/kg and 3.00€/Kg.

Figure 2.2 Peaches plastic tray

In the second sample peaches were in a plate of polystyrene and they did not have PDO Calanda logo (Figure 2.3). In this case, opinions were more unanimous and positive. The fruit size was similar to the previous sample but less homogeneous. Differences in sizes made them think that the sample was not a PDO product. Another factor that contributed significantly to have doubts was the smell because it was not pleasant.

Figure 2.3 Peaches in polystyrene tray

The third sample had peaches in a basket covered with a plastic film and it did not have the PDO logo (Figure 2.4). Their size was classified as calibre B in accordance to European Union Regulations (DOEU, 2004). It is not possible to appreciate the picture well, but its colour was a little bit green which indicated that peaches were still unripe. The general opinion of the participants in the group was that those fruits were unripe, odourless and too small. All believed that they did not have a good taste, they were not authentic PDO Calanda peaches and a piece would not be enough to satisfy quality expectations.

Figure 2.4 Peaches in basket

Fruit injuries are an important factor for consumers buying decisions. The fourth sample had injured fruit and some similarities to the previous sample. According to participants' opinions those fruits were not from Calanda area because they were unripe and odourless. They expected that those peaches should have bad taste and no juice. The maximum price they were willing to pay was in between 1.00€/kg to 1.50€ / kg.

The selling format of peaches of the fifth sample was bulk and they were not from Calanda area (Figure 2.5 shows fruits sold as bulk peaches, but they are not the sampled peaches). The pieces had unripe signs because of their darkest green colour (sample with less ripen fruits). Although their size was big (diameter about 80mm), there was a visible a size variation among peaches. The participants impression was that those peaches were of good quality.

Given their first assessment about quality, the moderator requested to participants whether they would chose one peach from the fifth sample (the last sample) or one from the first sample. Some participants preferred peaches from the first sample and others from the last sample. Those who preferred fruits from the first sample explained that they wanted peaches ready to eat while those who selected from the last sample (unripe) preferred to wait a while until peaches were ripen but they would be compensated with higher quality fruit.

Figure 2.5 Bulk peaches

When the session finished, moderators met to analyze the recorded information, to check that all participants interacted successfully and that the amount of information was sufficient to meet the research objectives.

In this kind of research, when the obtained information is considered to be sufficient, a general conceptualization can be reached. Although sufficient for work purposes, information should be interpreted with caution because data from Focus Group are not statistically representative of populations (Sim, 1998).

2.2.4 In-depth managers interviews

In-depth interviews with managers of fruit and vegetables sections, from major retail stores of Zaragoza city, were carried out to find out different perspectives of consumers behaviour towards PDO Calanda peaches. Although more expensive and time demanding than a Focus Group, this type of interviews has been considered relevant because these professionals have daily interactions with consumers and they know better than anybody else consumers fruit preferences in Zaragoza city.

Interviews were carried out in August-September 2008 with 7 managers from 4 retail companies. A semi-structured questionnaire, with 11 questions, was employed; 4 of them were dealing about how peaches' sales were managed in their establishments and 7 questions regarding their perceptions about how consumers value peaches quality, especially those with PDO Calanda, and what they thought about packaged peaches in boxes (bulk), baskets and trays. On average, it took about 45 minutes to answer all questions.

According to managers, peaches freshness and appearance were vital for consumers' purchases. So they have adopted a stock replenishment system of the type D + 1. This system works with orders been made at day "D" and the fruit is delivered at D + 1 (next day). The amount requested is based on predicted sales for next day plus a buffer margin. This buffer margin tries to avoid lack of peaches on shelves and varies according to establishments' size. The week days with best selling were on Fridays, Saturdays and Mondays.

To avoid losses (do not forget that peaches are perishable and very sensitive to injuries), retailers try no manipulate the merchandise with minimal handling and, in many cases, boxes are placed directly on the shelf. The lack of wounds increases product shelf life and it improves its appearance (easier to be sold). During the replacement process, freshly removed peaches from cameras are placed in the shelf's lowest levels while those peaches that were already on shelf are located at higher levels. Peaches at high levels are sold first and it avoids losing its quality

According to respondents, the quality of peaches that they are not under control of PDO Calanda, vary a lot. Their size, ripeness and damage vary greatly within and among boxes and their quality is not the same during the production season. In the case of PDO Calanda peaches, they have detected that earliest production are a little unripe and with smaller size (sizes go from 24 to 20[1]) than during the rest of the season. They consider that this lack of ripeness and size of PDO Calanda peaches is not a serious problem when they are sold. They explained that if consumers buy unripe peaches they may wait for a couple of days before eating them.

Many managers thought that PDO Calanda peaches have uniform quality within and between boxes. Even suffering the mentioned problems about their quality, on average, is maintained during its production season. They had the opinion that standardising peach quality helps sales and it minimizes consumers' uncertainty about product quality, which allows a better prediction of consumer behaviour.

[1] In this case, size of 20 means that there are 20 peaches in a box and 24 have 24 peaches.

Another distinctive aspect of PDO Calanda peaches has been their neat aspect. Respondents stated that bag production provides protection against dirt, insect bites and pesticides. They also asserted that there are peaches from other areas that employed bag in their production and sellers maintain some bagged fruits in boxes to communicate to consumers how they were produced. According to them, the presence of other fruits produced in bags is causing confusion over the authenticity of PDO Calanda peaches. So, it could happen that consumers when buying peaches produced in bags might be thinking that they are buying the authentic PDO Calanda peaches.

In order to identify peaches at retail level, different signs such as peach variety, quality type, origin, if peaches have PDO Calanda and advertising panels are used to indicate that they are the authentic peaches. One way to certify the authenticity of PDO Calanda peaches has been to have fruit stickers, which are the product's seal of authenticity provided by the Regulatory Council, and posters. The product traceability codes in the boxes are also considered that it is guarantee of authenticity.

PDO Calanda peaches are located, at distribution chains, where greater traffic of people exists to increase their sales. Some managers mentioned that placing peaches at the top of the shelves and arranging boxes so that customers feel a good product rotation may help to increase sales up to 30%.

The third factor that affects sales of PDO Calanda peaches is price. Although promotions and discounts are not standard practices at points of sale, respondents agreed that consumers are price sensitive. Normally, consumers consider that the price of PDO Calanda peaches is very high, but the price difference is compensated by its superior quality. Peaches are easily sold, and before the beginnings of the season, consumers always ask when they are going to be available in the market. The PDO brand is recognized in Aragon of peaches with a distinctive food taste. Its quality hardly disappoints consumers and this is the reason why PDO Calanda peaches are so desired.

At selling places, the features that are most appealing to consumers are fruit size, colour, appearance (in this case is considered clean and no damaged fruit), good smell, the origin (looking for the authentic PDO Calanda peaches). The fuzziness of the skin is not desired, although less important than other characteristics. There is a consensus that big peaches are most desirable. The most appropriate size should be size 20. Some think that larger than 20 would not be well accepted by all consumers and smaller peaches, size 24, would depreciate the product because it does not provide a differentiated distinction.

The peach colour has dual interpretations. One is related to the variety, yellow or red, and the other related to ripeness. According to respondents yellow peaches are considered sweeter than red and another advantage of yellow peaches would be that consumers are able to have clearer identification of ripen peaches than red peaches.

The last part of the survey refers to the use of different packages to sale peaches. Although most respondents believe that consumers prefer peaches in baskets or in trays, because they transmit a perception of superior quality, they consider that not all consumers would want peaches packed under those characteristics. Young consumers prefered more packaged fruits than on bulk.

The higher quality of packaged peaches should be accomplished by a more rigorous fruit selection, safer fruit and greater consumer's convenience. The packaged peaches should be safer because they are protected against damage and it prevents possible fruit contaminations. For them, there were many consumers who felt in disagreement when they saw other people touching fruits without gloves.

2.2.5 Price and quality characteristics of yellow peaches in the market

Retailers offer different selling formats (self-service or not) and they try to gain customers loyalty through their prices, product quality, products assortment and services. Retail companies tend to specialize in specific market segments to get more competitiveness. Casares and Martin (2004) and Casares and Martin (2006) explain that in Spain there are different formats of retail companies adopting different strategies to commercialise food in general, and more specifically fruits.

Two main commercial formats are considered in this part of study, hypermarkets and department stores. Carrefour tries to provide their customers with a large number of products at a low price in the market (Carrefour, 2009). It is a traditional objective for hypermarkets chains. Prices in those establishments can be taken as references for other large supermarkets and hypermarkets. El Corte Ingles is the biggest department store in Spain, with supermarkets as part of it. It seems to be more focused in a market segment that demands a greater number of services and consumers who need higher service quality than other establishments (El Corte Inglés, 2009). In this case, their prices may represent references for consumers' demands who are seeking products and services with high quality, and they are willing to pay a plus for it.

In our study peaches' characteristics and prices were assessed for yellow peaches in different establishments of those two chains stores in Zaragoza city. Data was collected weekly in Carrefour and in El Corte Inglés, between beginning of September of 2008 and middle of October of 2008. This period of time coincides with most part of the commercialization period of PDO Calanda peaches.

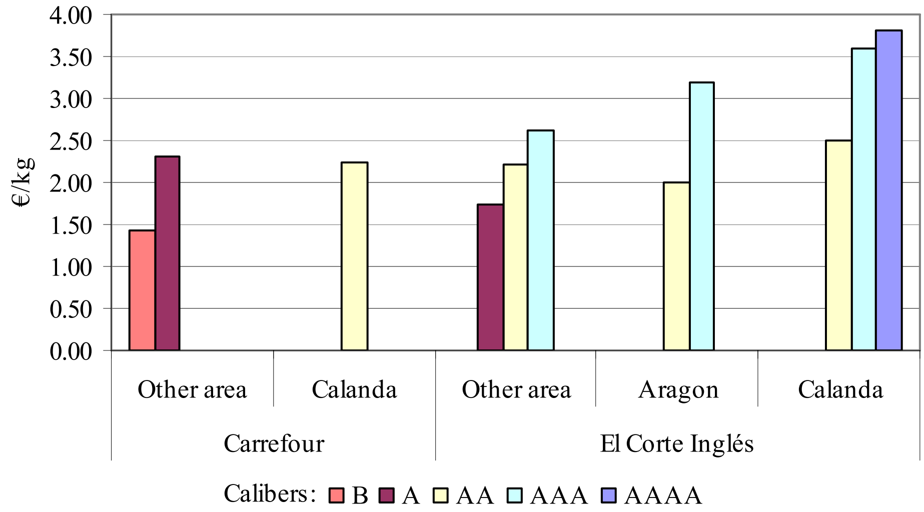
The reason for choosing two specialized retail chains dealing with different market segments, it was to seek a greater range of peaches prices and quality characteristics in Zaragoza, as it had been suggested earlier by Parker (1993) to better understand the entire market. In each observation, in addition to price, data were gathered about origin, fruit size, type of packaging and whether peaches were PDO Calanda or not.

Peaches price levels indices at retail establishments in Zaragoza city had great differences in the last quarter of 2008. The Municipal Market was the place where the fruit was sold at lowest price, with an index of 100. The same price index for Carrefour, in the Actur area, was 124, meaning that prices were 24% higher than at Municipal Market and the index of El Corte Inglés, at Paseo Independencia, was 155 (MITC, 2009).

According to the MITC price index (2009), El Corte Inglés charged 25% more for fruits than Carrefour. If we take the arithmetic average for yellow peaches prices, from these two establishments, the difference increases to 63.2%. However, if the comparisons are made from the obtained data between products with similar features, for PDO Calanda peaches of caliber AA, the difference is only 3.6% (Graphic 2.1).

The main reason of those price differences for peaches is the kind of offer that each establishment has. At El Corte Inglés peaches' sizes were larger than in Carrefour. In El Corte Inglés the smallest size was caliber A, while in Carrefour was caliber B and the maximum size of PDO Calanda peaches at Carrefour was caliber AA, while at El Corte Inglés was caliber AAAA. What is apparent from these data is that each establishment has been specialized in a market segment more or less demanding about fruit sizes.

Graphic 2.1 Prices average of yellow peaches, by origin and size, in Carrefour and in El Corte Inglés, at Zaragoza city, in 2008



Larger fruits are preferred to smaller ones. In general, prices are sensitive to the size; especially when calibers AA and AAA are compared. Price differential is not so great between calibers AAA and AAAA, presumably because peaches with caliber AAAA could be too large to be consumed by one person on a single occasion.

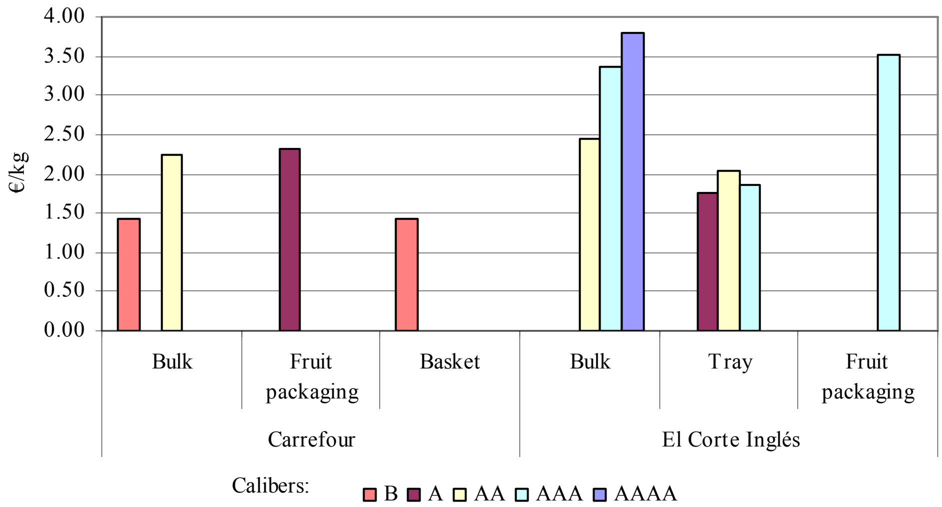
Origin also influences prices. At El Corte Inglés, on average, peaches from Calanda had higher prices than those from other areas. This difference on price could be explained by the guarantee of PDO peaches quality. Quality peaches from the Aragon area, which were not specifically from the Calanda area, also were preferred to those from other Spanish locations, except peaches with caliber AA.

Another value that must be interpreted cautiously is the price of peaches from the Calanda area with caliber AA, at Carrefour, which is 3% lower than the caliber A from other areas of Spain. This discrepancy could be explained by the type of packaging, as peaches from other parts of Spain were sold in trays while peaches from the Calanda area were offered on bulk (Graphic 2.2).

Graphic 2.2 shows that consumers from Carrefour are practically indifferent between bulk peaches and peaches sold in baskets. The same indifference exists between bulk peaches in plastic trays and those with caliber AAA at El Corte Inglés.

These results determine that the worst type of package (valued with a lowest market price), at El Corte Inglés, are peaches placed in trays.

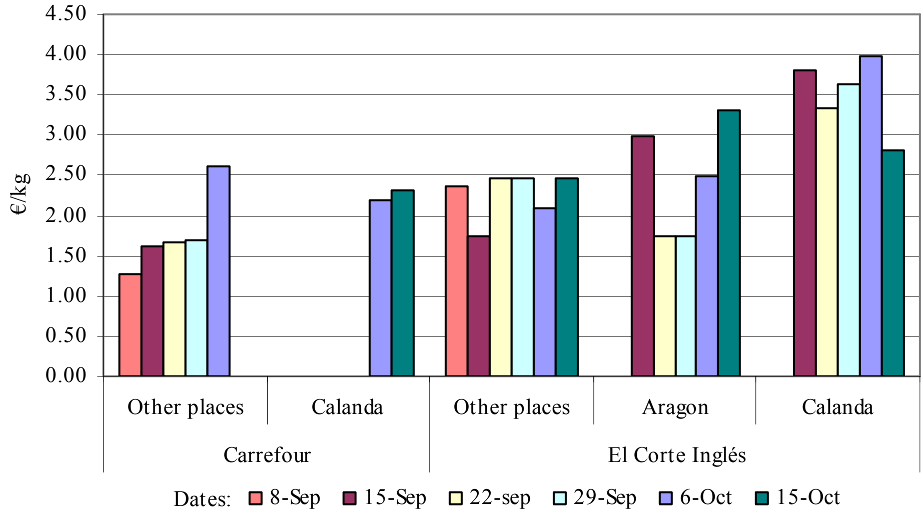
Graphic 2.2 Prices average of yellow peaches, by fruit size and type of packaging, at Carrefour and El Corte Inglés, in Zaragoza city, in 2008



According to (CRDOMC, 2009), the harvest time of PDO Calanda peaches began, in 2008, on September 11th. Graphic 2.3 shows that since then Carrefour took more than three weeks to offer PDO Calanda peaches, while El Corte Inglés took only few days. This observation suggests that consumer demands quicker reactions for high quality products in more exigent market segments. Availability is an important feature for a product with a short commercial period.

During the observed period average peaches prices increased on average. It was found that peaches with the same characteristics had similar prices along the commercial season but the prices differences among different characteristics defining quality types were quite big. At the end of the harvest season peaches were bigger, sold in more appreciated packaging and with the PDO Calanda certification.

Graphic 2.3 Evolution of yellow peach prices, by origin, in Carrefour and El Corte Inglés, at Zaragoza city, in 2008.



2.3 Selected peaches attributes and levels

Consumption of peaches is relatively low in comparison with other fruits. They are sold during summer and PDO Calanda peaches only at the end of the season, two months at most. Consumers do not have good skills to judge peaches quality by their appearance and to identify ripen fruits with good flavour. From the analysed data it can be inferred that quality requirements of PDO Calanda peaches, has influenced their high price positioning at retail, satisfying consumers who demand high quality products.

From the two analysed type of retails formats, it can be deduced that the establishment that sells peaches with the highest quality, it also offers a wider range of different peaches than the other establishment. In the first establishment, fruit sizes are bigger and there are more possibilities for different types of packaging.

Less exigent consumers are indifferent between peaches packed in baskets or in bulk. Peaches conditioned in trays are less considered in the establishment specialized in high quality products. In both cases buyers value slightly more fruit in trays than in bulk.

With regard to the price evolution along the season changing peaches characteristics defining seem to quality affect prices more than changes in supply and demand in this period. Another aspect is that the establishment dealing with more exigent costumers react faster providing quicker availability since the beginning of the season. However, in the other establishment it took three weeks after starting productions and commercialization of PDO Calanda peaches.

According to previous studies and the market observations gathered from the Focus Group, managers' points of view plus supply in the market, at retail level, ten attributes have been selected to analyse PDO Calanda peaches quality with respect to consumer reactions in a first experiment. A limited number of attributes with levels have also been selected is a second experiment. In this case, it was important to select attributes with levels which could be differentiated by consumers in a survey.

It is important to pinpoint that, in the first experiment, consumers were only trying infer PDO Calanda peaches and their attributes whereas, in the second experiment, consumers were dealing with peaches from diverse origins.

In the first experiment, attributes have been assigned to the reference classification of search, experience and credence. A great number of them are considered as search attributes: maturation stage (colour, smell and size), type of packaging and skin fuzziness. There are only an experience attribute (taste) and a credence attribute (produced in bags). Some of the search attributes are a result somehow of previous experiences as well. Whereas the credence attribute has two components, one is the previous knowledge about it and the second is the judgement that consumer might undertake when buying it.

For the second experiment, four search attributes have been selected: price, origin, packaging and size. Origins could have two interpretations, as search and credence attribute. For example, consumers search PDO Calanda peaches in the market but at the same time they have to rely on the information provided at selling points because they do not have the opportunity to contrast it. In our case, it is important to point out that all attributes can be measured objectively in order to define objective quality. However, some of those measurements can be rather difficult to undertake or not economically viable in the business.

In the second experiment, each attribute has 3 levels. Price has been introduced because it is an important attribute that influence consumers' purchase decisions and it enables the estimation of consumers' willingness to pay when they move from one attribute level to another. Willingness to pay is an easy parameter for commercial operators and policy makers. Price levels have been selected following prevailing peaches market prices in Zaragoza city during the selling season of PDO Calanda peaches. Peaches price levels for the first survey in 2008 were: 1.5€/kg, 2.5€/kg and 3.5€/kg, and for second survey in 2009: 1.2€/kg, 2.4€/kg and 3.6€/kg. Prices levels were slightly different, in 2008 and in 2009, to reflect market differences between the two years and to increase the price range in the second year for better evaluation of consumer' sensitiveness with respect to price. Differences among price levels were 1.0€ in the first year and 1.2€ in the second year.

The choice experiment had an attribute called origin with three levels: one level is "peaches from (produced in) Calanda area with Protected Designation of Origin (PDO)", other is "peaches from (produced in) Calanda area without Protected Designation of Origin (PDO)" and the last one is "peaches from (produced in) other areas different from Calanda and without any Protected Denomination of Origin (PDO)".

They were coded as effect codes for estimation purposes. The reference level for origin has been "peaches from Calanda without PDO". This reference and codification allowed to determine differences for consumers' marginal utility and willingness to pay between peaches produced in the Calanda area, with and without PDO brand, and between peaches without PDO brand, but from Calanda area and from other areas always from Calanda. The first difference represents how much consumer's value the PDO Calanda brand and the second is how much they value peaches produced in Calanda area. It is necessary that the brand value should be higher than costs related to certification and control.

In the second choice experiment, packaging was included with three levels or three types of packaging. The types of packaging considered were: normal packing, active packing and peaches in bulk. During the survey consumers had to decide between those alternatives. Active packing has the same appearance but it maintains peaches, with the same quality, 12 days more than with normal packing. Consumers were also informed that active packing does not have adverse health effects or it does not change the fruit taste. Bulk peaches are those that would be disposed in boxes in supermarket or hypermarkets.

For estimations purposes, normal packing was coded as the reference for packaging. The aim was to estimate marginal utilities and willingness to pay when consumer changed from normal package to other types of packaging. Then the difference between normal packing and bulk peaches would represent the utility or disutility and how much peaches, conditioned on plastic trays, affect consumers purchase decisions. Before applying the survey, the expected results for the entire sample was no clear it was evident the existence of market segments with different behaviour towards these two attribute levels.

Active packing was incorporated in the choice experiment because it is technically available for the peach industry, although peaches sold that way were not found and it represents an opportunity to differentiate peaches from other fruits, although in Zaragoza city. It was also expected that results would show how much consumers value the possibility to have peaches in good conditions at home for an extended period. It would represent the opportunity cost of having stocked peaches.

The fourth attribute was peach size and there were three levels: small, medium and large. When questionnaires were applied, samples of peaches with different sizes were shown to consumers. Small size peaches weighted around 180g; a medium peach weight was around 250g and big size peach was around 380g. The election of these sizes was based on consumers' ability to eat them. Considering comments made in the Focus Group, for a normal person it would be necessary to eat many small size peaches to satisfy his hunger but, in the case of a medium size peaches, probably one peach would be enough to satisfy it, which is approximately the minimum size allowed for peaches with PDO Calanda and for big size peaches, not everybody would be able to eat one entire piece at once. People are not able to eat the big size and they would share it with other person or keep it for later consumption.

The expected result was that there would be a positive relation between peach size and utility for a great part of consumers. However, it was also expected that for some people big size peaches would provide negative utility and for other consumers small size peaches would result in positive utilities.

Chapter 3: Sampling and PDO Calanda peaches consumption

3.1 Introduction

The purpose of this chapter is to describe how two surveys were carried out to study consumers' preferences of PDO Calanda peaches in Zaragoza city and to show first results about consumers' behaviour toward this product.

Sampling error margins were estimated for each survey in order to check sampling reliability. Then, each survey describes the demographic characteristics of consumers and compares the sample profiles with the profile of the Aragonese population.

Latter, consumers' attitudes toward PDO Calanda peach, from each sample, are described. Then, we describe the basic differences between regular and sporadic consumers of PDO Calanda peaches. Finally, considerations about the main findings from the data considered are exposed.

3.2 Sampling

Two surveys were carried out to study consumers' preferences of Protected Designation of Origin (PDO) Calanda peaches in Zaragoza city. The first was performed in 2008 and the second in 2009. Both surveys were performed during the PDO Calanda peaches marketing season, which usually happens since the beginning of September until middle of November. The reason to undertake the surveys during the marketing season was that consumers should have those products more in mind. In both years, surveys were applied to those customers who were attending Carrefour hypermarkets in Zaragoza city.

Customers were selected randomly. The interviewer, properly identified as staff of the Agrofood Research and Technology Centre of Aragon (C.I.T.A.), first explained that he was conducting research about late season peaches' consumption in Zaragoza city. Then, respondents were asked if they had consumed PDO Calanda peaches, at least, once in the last two years. In case of a positive answer, consumers were informed that the survey was going to take around 20 minutes and they were invited to participate. In total, information from 316 PDO Calanda peaches consumers in 2008 and of 212 in 2009 was collected.

Sampling errors were estimated for both surveys. Equation 3.1 is used to estimate sampling errors for infinite populations. Trespalacios *et al.* (2005) affirm that populations with more than 100.000 individuals can be taken as infinite. According to municipal censuses data, published by IAEST (2009b and 2009c), Zaragoza city had 666,129 inhabitants in 2008, so this equation was employed to estimate the sampling error.

$$e = \sqrt{\frac{K^2 PQ}{N}} \qquad 3.1$$

Where:

N = Sample size

K = Constant which depends on desired confidence level

P = Probability of selecting the target population

Q = Probability of no selecting the target population

e = Sampling error

PDO Calanda peaches consumers are the target population in this study and there is no information about how many PDO Calanda peaches consumers are in Zaragoza city. Then, it was considered the same probability of selecting target and non target population. Variable values, of P and Q, were 0.5 (50%) for both surveys. Therefore, surveys' sampling errors estimations of 2008 and 2009 is 5.6% and 6.9%, respectively (Table 3.1).

After finishing the questionnaire, interviewers checked all questions for wrong answers. The experience showed that most mistakes were related to choices experiment tasks. To reward consumers' efforts, it was given about 1kg of PDO Calanda peaches to each participant. There were remarks before starting the questionnaire of not having more than one interview from members of the same household.

Table 3.1 Technical data of surveys in 2008 and 2009.

Parameters	Survey 2008	Survey 2009
Area of sampling	Zaragoza	Zaragoza
Place of sampling	Hypermarkets Carrefour	Hypermarkets Carrefour
Population	Consumers who had bought PDO Calanda peaches over past two years	Consumers who had bought PDO Calanda peaches over past two years
Sample selection	Simple random	Simple random
Sample size	316 consumers	212 consumers
Confidence	95%	95%
Sampling error	5.6%	6.9%
Sampling date	From October 30th until November 6th 2008	From October 1st until 22nd 2009

3.3 PDO Calanda peaches consumers profile in Zaragoza city

3.3.1 Survey of 2008

The questionnaire used in 2008 can be found in Appendix 1 for the English version and in Appendix 3 for the Spanish (original) version. It is divided in three parts. The first deals with consumers' attitudes towards PDO Calanda peaches. In the second part there are two choice experiments and in the third part consumers' socio-demographic information was asked. In this section, only results of the first and last parts are exposed. These data are first analyzed by univariate analyses and then by bivariante analyses.

3.3.1.1 Univariate analysis

3.A) Consumers socio-demographic description

Consumers' characteristics are shown in Table 3.2. Consumers' ages were calculated from their birthdates and are grouped in five age classes. These age classes have the same range than the statistical information from Aragon. In 2008, the average age of the Aragonese population was 42.9 years old and the average age for PDO Calanda peaches consumers was 46.5 years old.

The percentage of women (59.2%) on the survey was higher than for the Aragon population (50.1%) and this is a desired characteristic to reflect the real percentage of women buying peaches in the market. According to Cerdeño (2006) women are to a great extent responsible of fruits and vegetables purchase in Spain. CM (2005) also confirm that food purchase is more often an exclusive women job for 66% of the households in Madrid, and it is undertaken exclusively by men only in 7% of cases. According to the same source men share buying responsibilities with their wife because they plan together what to buy. In 27% of situations men and women take the responsibility of food purchase by turns or they go shopping together. Probably, this behaviours is similar in Zaragoza city.

Table 3.2 Survey socio-demographics characteristics.

Characteristic	Survey sample Number[2]	Survey sample %	Population[1] %
Consumers age (years old)			
From 15 to 25	17	5.4	11.9
From 25 to 35	62	19.6	18.4
From 35 to 50	110	34.8	26.9
From 50 to 65	80	25.3	20.1
65 years or older	47	14.9	22.7
Average age	46.5		42.9
Consumers gender			
Female	187	59.2	50.1
Male	129	40.8	49.9
Consumers education			
Elementally	87	27.5	34.1
High school	130	41.1	41.4
College	99	31.3	24.4
Total	316	100.0	100.0

Source: 1) From IAEST (2010) for the population of Aragon

2) Refers to the number of consumers

Survey consumers have higher education level, on average, than the average population of Aragon. The percentage of consumers attending college is 31.3% and elementary school is 27.5%, while in Aragon those percentages are 24.4% and 34.1%, respectively.

Consumers from the survey live in larger size families than the average population of Aragon in 2006. There are 2.65 persons per household in Aragon (INE, 2008) and 3.16 in the survey (Table 3.3). In the survey, 6.6% of the households are of only one person and 41.1% (21.2% of only children + 17.1% teenagers + 2.8% of children and teenagers) of households have children and/or teenagers and in Aragon these percentages are 40.18% and 35.13%, respectively.

Table 3.3 Survey households' characteristic.

Characteristic	Number[2]	%
Family size (number of persons)		
1	21	6.6
2	91	28.8
3	82	25.9
4	85	26.9
5 or more	37	11.7
Average (persons/household)	3.16	
Children and teenagers		
Children (< 10 year old)	67	21.2
Teenage (10 - 20 years old)	54	17.1
Both (children and teenage)	9	2.8
Activity		
Full time at home	124	39.2
Part time outside home	37	11.7
Full time outside home	155	49.1
Household income (€/month)		
Less than 900	23	7.3
From 901 to 1,500	84	26.6
From 1,501 to 2,100	72	22.8
From 2,101 to 3,000	81	25.6
From 3,001 to 4,000	32	10.1
More than 4,000	24	7.6
Total	316	100.0
Average house characteristics		
Area (m^2)	92.2	
Bathrooms (number)	1.6	

Professional activities influence fruit and vegetable consumption. Table 3.3 points out that 60.8% of food buyers have activities outside home (49.1% full time outside home + 11.7% partially outside home), and those working outside home account for 49.1%. In 2008, there were 611,700 active working people in Aragon (IAEST, 2009a) and 56.2% of those working outside home have more than 20 years old (IAEST, 2009b).

The living conditions survey, conducted by INE (2008), indicates households' incomes in Aragon (Table 3.4). Annual income was converted into monthly income in order to compare these data with PDO Calanda peaches consumers households income (Table 3.3).

Table 3.4 Households average income in Aragon in 2007

Annual income (€)	Monthly income (€)	Households (%)
Less than 9,000	Less than 750	12.0
From 9,001 to 14,000	From 751 to 1,167	10.9
From 14,001 to 19,000	From 1,168 to 1,583	15.1
From 19,001 to 25,000	From 1,584 to 2,083	15.6
From 25,001 to 35,000	From 2,084 to 2,917	21.4
More than 35,000	More than 2,917	25.0

Source: INE (2008)

PDO Calanda peaches consumers have incomes more centered to around middle levels than households' income in other survey for the entire Aragon. There is a higher proportion (12.0%) of low-income level (less than 750€/month) in Aragon than in the survey (7.3% get less than 900€/month). There is also a higher percentage (25.0%) of households in Aragon who earn more than 2,917€/month while there are 17.8% (10.1% + 7.6%) in the survey who exceed 3,000€/month. Income levels between 901 and 2,100 €/month are more common in the PDO Calanda peaches consumers' households.

3.B) Consumers' attitudes toward PDO Calanda peaches

Around 45% of people repeat their behaviour almost daily and usually in the same context (Quinn and Wood, 2005). Purchase and consumption are based commonly on repetitions. Consumers tend to buy similar brands of products and amounts at a given retail store across repeated visits (Vogel *et al.*, 2008) and eat similar type of foods at meals across days (Khare and Inman, 2006).

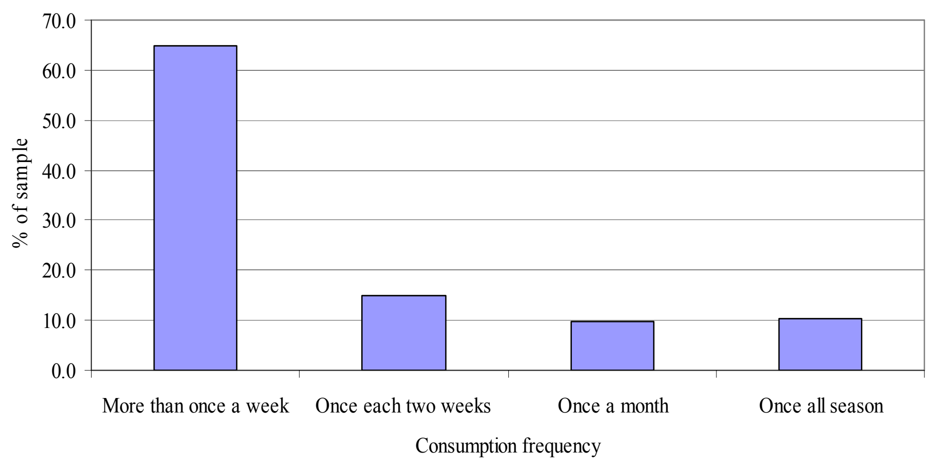
In the survey, consumers state in 64.9% of cases that they consume PDO Calanda peaches more than once a week (Graphic 3.1). Smaller percentage of consumers (14.9%) eats PDO Calanda peaches once each two weeks, 9.8% once a month and 10.4% only once during the season.

Other studies define consumers according to their purchase or consumption frequency as regular, occasional and sporadic. Carrasco *et al.* (2006) use this classification for wine consumers and Bañón *et al.* (2004) for pig meat consumers. This classification is interesting because normally regular consumers have higher knowledge and more detailed information about the product. The possible limitation of regular consumers is their more radical points of view than sporadic consumers with respect to product quality. Sporadic consumers may have lower knowledge about product quality, but they are considered a good information source for the potential market segment of a brand (Reynolds and Olson, 2001).

This kind of classification has been employed to separate PDO Calanda peaches consumers. Thus, regular consumers are those who consume PDO Calanda peaches at least once a week and sporadic consumers are those who consume PDO Calanda peaches less than once a week.

Grouping consumers according to their PDO Calanda peaches consumption frequency is a useful way to understand its market. However, does a regular consumer eat more than an average consumer?

Graphic 3.1 PDO Calanda peaches consumption frequency in Zaragoza city in 2008



In Aragon, peaches average consumption in 2008 was 7.28kg per capita. Out of this amount, 23.4% was consumed between the middle of September until the first week of November (7 weeks), so each person in Aragon ate 1.7kg of all sort of peaches during that period (MMAMRM, 2010a). According to Polo and Albisu (2010), during the marketing period of PDO Calanda peaches in 2006 that fruit accounted for 84.4% of total sold peaches in the hypermarket of Carrefour of Zaragoza city. Taking into consideration that information, it is possible to estimate, in 2008, the amount that each person demanded in Zaragoza city, on average was 1.44kg of PDO Calanda peaches which corresponds to 210g/week.

Considering that each PDO Calanda peach weights, on average, around 260g[2], a consumer who eats PDO Calanda peaches more often than once a week would demand more than 260g/week. The demand for a consumer who eats once each two weeks (assuming it is 0.5 times a week) would be 130g/week[3], those that eat once a month (it is around 0.25 times a week) would demand around 65g/week and consumers who eat just once during the entire season (it is approximately 0.15 times a week) would demand around 39g/week.

Regular consumers eat more than 260g of PDO Calanda peaches per week and they represent 64.9% of PDO Calanda peaches' consumers. So, 64.9% of PDO Calanda peaches consumers were eating at least more than 50g per week (260g – 210g) the average consumers in Zaragoza.

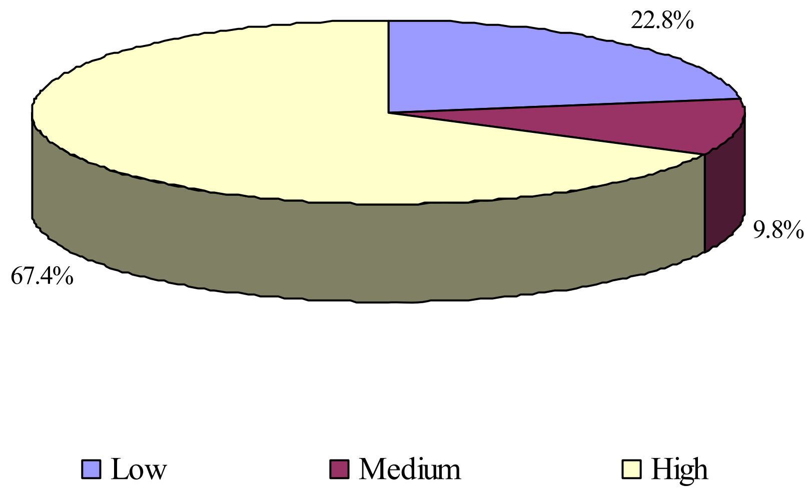
Product consumption frequency and repeated purchase, is positively related with consumer satisfaction and loyalty (Espejel *et al.*, 2007b). Thus companies try to improve consumers' satisfaction and loyalty to improve product selling.

The survey included a question to measure the degree of consumers' loyalty towards PDO Calanda peaches. It was asked which fruit would buy if PDO Calanda peaches were not available in the market. In total, 17 fruits were mentioned, the main ones were: other peaches (23% of consumers), apples (14%), oranges (12%), bananas (9%) and melons (9%). People who mentioned that they would buy other peaches are considered as consumers with lowest loyalty degree towards PDO Calanda peaches. Those who mentioned that they would buy other kind of stone fruit, for example

[2] This weight is found dividing the PDO Calanda peaches box average weight (Regulatory Council considers it around 5kg) by the average number of peaches in each box. The average number of peaches in each box was calculated from cooperatives available information (Gil, 2010).
[3] For this estimation it was assumed that a person eats just one peach at each consumption occasion.

nectarines, are considered as consumers with medium loyalty degree. Consumers who would not get another stone fruit are considered as consumers with highest loyalty degree. Graphic 3.2 shows percentages of consumers with high, medium and low loyalty degrees toward PDO Calanda peaches, in Zaragoza city, in 2008.

Graphic 3.2 Percentages of consumers with different loyalty degrees toward PDO Calanda peaches in Zaragoza city in 2008

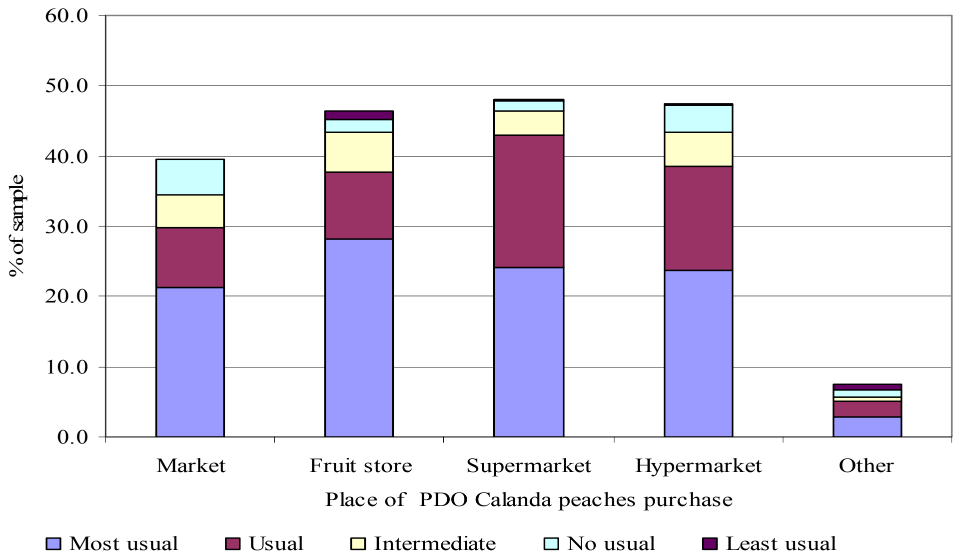


Consumers from Zaragoza city are loyal to the PDO Calanda brand. More or less 2/3 of them would buy very distinct fruit if they do not find PDO Calanda peaches in the market, while 22.8% would buy another peach and 9.8% would purchase a stone fruit. According to Millward Brown (2002), 18% of Spaniards always buy the same beverage and foodstuff brand. Dairy products are positioned as those with the strongest consumers' brand attachment. Thus, around 43% of Spaniards feel in that situation. Comparing this value with the PDO Calanda peaches loyalty degree, it can be consider that the loyalty degree to PDO Calanda peaches in Zaragoza is very high.

Next issue was to address where consumers purchased PDO Calanda peaches. In the survey, consumers were asked to rank places were PDO Calanda peaches were purchased, from most usual to least usual. There was the option not to answer if they did not use to buy the product in a place. Graphic 3.3 shows main results for this question.

Irrespectively from the shopping frequency, consumers buy PDO Calanda peaches in supermarkets (48.1%), hypermarkets (47.5%), fruit stores (46.5%) and markets (39.6%) and a small percentage buy peaches elsewhere (7.6%), such as in the field (farmers), cooperatives in the PDO area and also in fairs dedicated to promote local fruits.

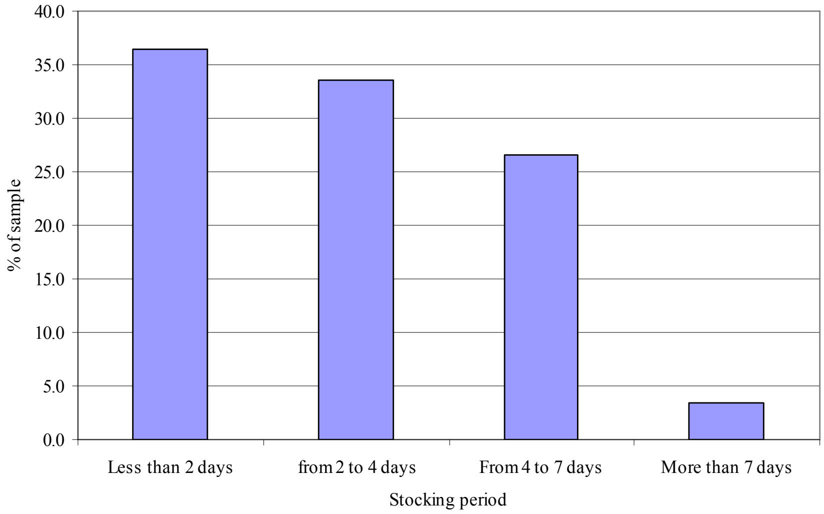
Graphic 3.3 Places where PDO Calanda peaches were purchased in 2008



However, consumers buy PDO Calanda peaches most usually in fruit stores (28.2%) and supermarkets (24.1%) come in second place, followed by hypermarkets (23.7%), markets (21.2%) and other shopping places (2.8%). According to MMAMRM (2010a) fruit shops sold 32.2% of total peaches in Spain in 2008. The market share of supermarkets was 30.9% and it was followed by local markets (23.2%), other shopping places (8.3%) and hypermarkets (5.4%). The greatest difference between PDO Calanda peaches consumers and Spanish data is the great significance of hypermarkets for PDO Calanda peaches' consumers. A plausible explanation of this difference is that hypermarkets were the places where surveys were conducted.

As mentioned in Chapter 2, peaches postharvest handeing is a sensitive marketing issue. Therefore, two questions were incorporated in the questionnaire. One question was about the storing period of PDO Calanda peaches at home, from their purchasing time until their consumption. Second question refered to the storing place for PDO Calanda peaches at home before consumption. Responses of first and second questions are displayed in Graphics 3.4 and 3.5, respectively.

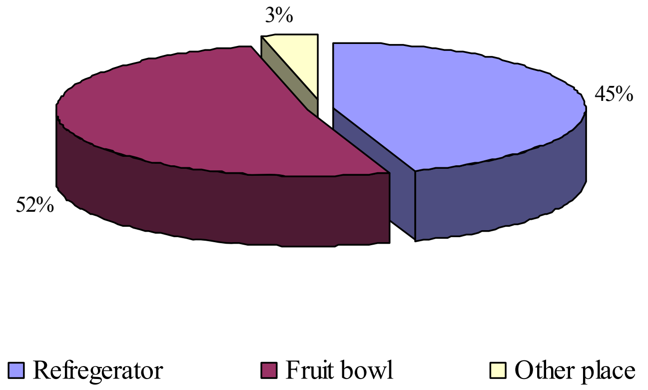
Graphic 3.4 Storing period of PDO Calanda peaches at home



The greatest part of consumers (36.4%) eat PDO Calanda peaches before the second day after purchase. It means that consumers of PDO Calanda peaches in Zaragoza would like to buy ripen peaches or “ready to eat” when purchasing them. As peaches are very perishable, there is a tendency to store them for a short period of time. Based on information from Graphic 3.4, the lowest storing period is usually 7 days. Almost a quarter of consumers store peaches at home between 4-7 days but only 3.5% store peaches longer than 1 week at home.

The most common place to store PDO Calanda peaches at home is the fruit bowl. A great part of consumers (52%) maintain these peaches mainly in fruit bowls and 45% preserve them in refrigerators. Only 3% of consumers keep PDO Calanda peaches elsewhere, such as in pantries, terraces and cold places in the house (Graphic 3.5).

Graphic 3.5 Store places of PDO Calanda peaches at home



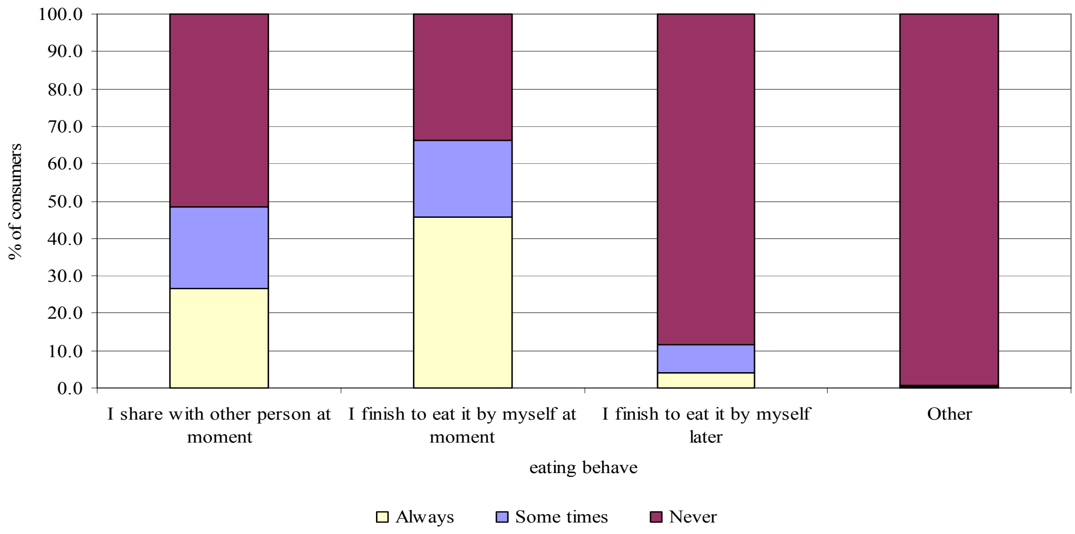
Eating big peaches can be a problem for some people. In this part of questionnaire it was shown a PDO Calanda peach weighting around 380g, which was considered the largest size available in the market. Four eating possibilities were suggested: sharing it with another person, eating it by themselves at once, eating it at several periods of time and the fourth possibility corresponds to other sort of behaviour. For each option, respondents had to declare if they used to adopt either always decision[4], sometimes or never. Results are displayed in Graphic 3.6.

Normally, consumers behave the same way. Around three quarter of consumers stated that they always take the same option when they eat the largest peaches. Around 46% and 20% of consumers declared that they, always and sometimes, eat by themselves at once, respectively. It means that 34% of consumers could never or sometimes eat the largest PDO Calanda peaches by themselves. Around half (48%) of consumers share the largest peaches with other person, either sometimes or always. Just 11.7% of consumers state that they eat them at several periods of time.

Results prove that consumers prefer to eat peaches by themselves, at once, and they dislike sharing them with other people. PDO Calanda peaches, weighting around 380g, never or sometimes fit consumers' eating expectation with 34% and 20% of the respondents, respectively.

[4] If a consumer stated that he eats sometimes the largest peaches by one way or he could also mark sometimes for one or more different consumption ways.

Graphic 3.6 Different eating behaviour for the largest PDO Calanda peaches

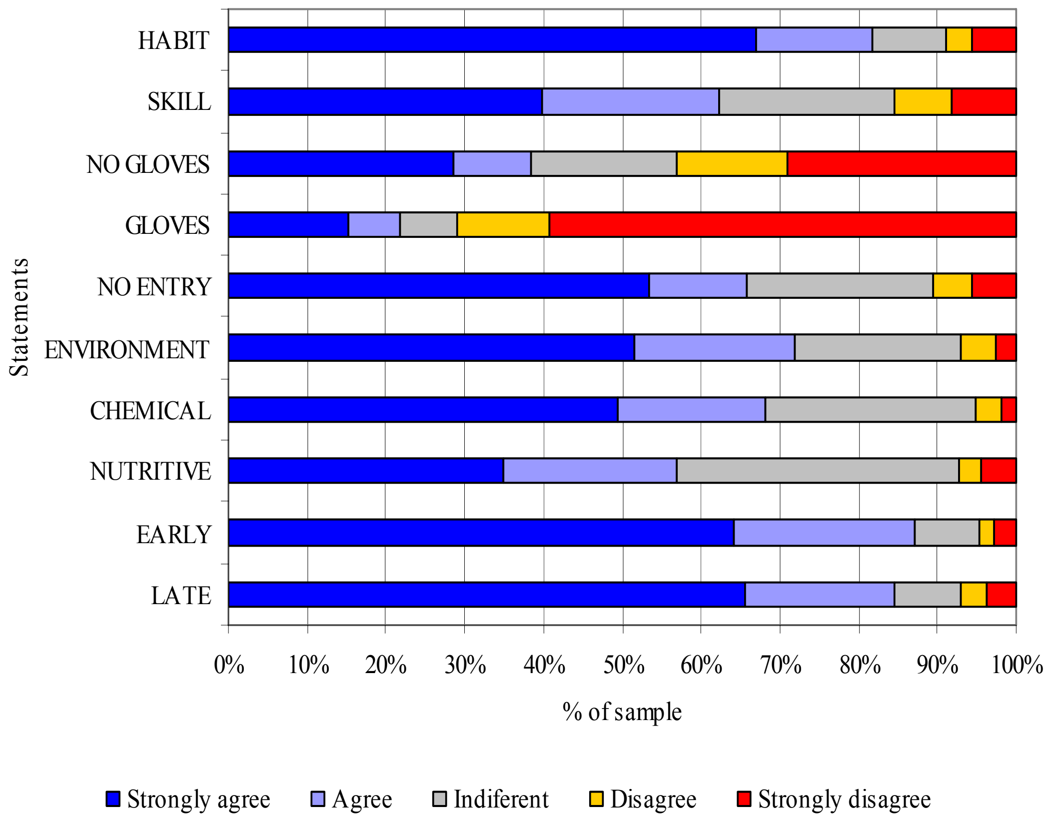


Research also assessed consumers' attitudes towards quality aspects of PDO Calanda peaches, consumption habits and food safety options by using Likert scales. In this scale, score 5 was given by consumers who strongly agreed with the statements and they scored 1 if they strongly disagreed. Three was the middle point when neither agreed nor disagreed (in the graphic it is represented as "indifferent").

In total, each consumer scored 13 statements. To simplify the results, statements are represented as follow: "Peach is a fruit that I have the habit of consuming it since my childhood" is HABIT, "I have qualms about buying fruit that have been touched by others on the shelves" is NO GLOVES, "If all consumers wear gloves, I still feel hesitant to buy touched peaches" is GLOVES, "If I buy peaches with PDO Calanda I avoid selling peaches from other places and I get benefits with Aragon's economic development" is NO ENTRY, "When I buy peaches with PDO Calanda I know that the environmental quality in the production area will improve because cleaner production techniques are used" is ENVIRONMENT, "Eating peaches with PDO Calanda is healthier than other peaches because they use less fertilizers and pesticides" is CHEMICAL, "Peaches with PDO Calanda is more nutritive than other peaches" is NUTRITIVE, "At purchasing, I am able to identify perfectly those peaches that have the best quality and taste" is SKILL, "If It had the same quality, I would like to buy peaches with PDO Calanda since August" is EARLY, and "If It had the same quality, I would like to buy the peaches with PDO Calanda during the months of November and December" is LATE. Results of all these statements scorings are shown at Graphic 3.7.

In Zaragoza city, consumers eat peaches usually since childhood. PDO Calanda peaches consumers confirm, in 67% of their answers, that they strongly agree and 15% agree with the statement that they use to eat peaches since their childhood. Only 6% are strongly in disagreement. While few consumers do not eat peaches since their childhood, a greater percentage of them have problems to identify the highest quality and tastiest peaches. Approximately 40% consider that they have very good skills to recognize the highest quality peaches and they strongly agreed with the statement, and 22.2% have a good ability (they agree with statement) and 22.5% have intermediate abilities on this task because they score 3. One way that consumers evaluate peaches ripeness is by touching.

Graphic 3.7 Consumers' agreement degree about peaches statements in 2008



Touching fruit may injury peaches or get them in bad state. Many self-service establishments (supermarkets and hypermarkets) offer plastic gloves to customers to take fruits, but sometimes not all costumers wear them. In the questionnaire there were two statements about touching peaches at purchase location. One statement saying that consumers would feel disturbed when other people touched peaches without gloves. Other saying that they would feel disturbed even if other consumers touched peaches wearing gloves.

Consumers prefer that others wear gloves when they purchase peaches. Answers show that 29% of consumers strongly agreed and 28% strongly disagree that they feel disturbed if other person would touch peaches without gloves, while 59.2% strongly disagree that they feel disturb when other person touches peaches with gloves.

Ethnocentrism is another aspect addressed in the questionnaire. In marketing, ethnocentric behavior is characterized by consumers' preferences for local products because they think it can help them by improving the local economy. To estimate consumers' ethnocentrism levels Shimp and Shama (1987) proposed a scale, known as CETSCALE. CETSCALE is covered by 17 statements in which consumers have to indicate their agreement and disagreement level. In our case, it was used just one statement. The statement was "If I buy peaches with PDO Calanda I avoid selling peaches from other places and I get benefits from Aragon's economic development".

PDO Calanda peaches consumers are ethnocentric. Results show that 53.5% of consumers strongly agreed and 12.3% agree that buying PDO Calanda peaches avoid other peaches sales and it would benefit them by promoting the local economy. This value can be considered quite close to the 48.9% of consumers who find to have high ethnocentrism level in Zaragoza city (Camarena, 2010).

Consumers had also to assess quality aspects of PDO Calanda peaches. There are two statements about the environment and one about fruit nutritional aspects. In general, consumers think that PDO Calanda peaches are healthier and friendlier for the environment. About half (51.6%) say that they strongly agree that PDO Calanda peaches pollute less than other peaches because cleaner production techniques are employed. Many consumers mention the benefits of using bagging production systems. Only 7% show some nonconformity with the statement and 21.2% express no opinions, as they neither agree nor disagree with the statement. Almost half of the consumers

(49.4%) strongly agree that PDO Calanda peaches are healthier because they use less fertilizers and pesticides. The number of consumers who disagree with this statement declines to 5.1%.

With regard the nutritional aspects, 34.8% of consumers declare that they strongly agree that PDO Calanda peaches are more nutritious than other peaches and 22.2% are in agreement with it. In this statement, the number of consumers who neither agree nor disagree is also significant (35.8%).

Last two questions have been drawn up to provide consumers point of views in relation to the extent PDO Calanda peaches marketing season, one statement suggested to offer the product earlier and the other later. This issue is very sensitive because many consumers associate this product to a short period of time.

Consumers recommend that PDO Calanda peaches can be produced earlier as well as later because both practices have similar impacts for them. Around 23% of consumers agree and 64% strongly agree that they would like to buy PDO Calanda peaches since August, i.e., advanced product supply. About 19% of consumers agree and 65.5% strongly agree that they would like to buy peaches later, during November and December. In both cases the product should have the same quality that they are used to have nowadays.

Polo and Albisu (2010) also study the possibility of expanding PDO Calanda peaches supply, but from the wholesalers' point of view. Their results show that wholesalers would prefer to offer the product earlier than later. This different of point of view may be explained by the product quality. According to their perceptions, peaches would be offered earlier by new varieties of peaches and the supply would be delayed when peaches are stored in refrigerated facilities. They also detect that there is a lack of confidence from wholesalers, when PDO Calanda peaches are kept under refrigeration. This explains preferences for the earliest offering and their divergence.

3.3.1.2 Bivariate analysis

Bivariate analysis is used to study the relationship or dependence degree between two variables (Pedret *et al.*, 2000). In this study, it has been used the Chi-square test and the U test of Mann-Whitney. Chi-square is used to estimate if there are relationships between two variables. The chi-square statistic of Pearson is calculated, which contrasts the hypothesis of no dependence between qualitative variables. Not only dicotomic characteristics, such as gender, presence of chikdren and presence of teenagers in the household, but other characteristics such as consumption frequency, loyalty degree, storage place, storage period, age, education level, family income and professional activity were analised as qualitative variables. These qualitative variables were coded as dummy. For example, variable took value 1 if consumer was from a specific class of age and it took value 0, otherwise. It was not took into account that some variables (consumption frequency, loyalty degree, age group, education level and family income) could be coded analysed as ordinal variable because they were also analysed as dummy variables in interaction models, between consumer and product feature, delt in the Chapters 4, 5 and 7.

For ratings tasks, Likert scale variables are considered as ordinal numeric variables (ordinal variables also are listed in Table 3.5, as well all variables) and they are analysed with the U of Mann-White test. This statistic deals with nominal and ordinal variables (ranking). The null hypothesis is that mean ranges for groups are equally distributed.

Table 3.5 Variable classification

Variable group	Variable	Type of variable
Consumers' habits and behaviour toward PDO Calanda peaches	Consumption frequency	Dummy[1]
	Loyalty degree	Dummy
	Storage place	Dummy
	Storage period	Dummy
Socio-demographic	Gender	Dummy
	Age group	Dummy
	Education level	Dummy
	Family size	Dummy
	Presence of children	Dummy
	Presence of teenagers	Dummy
	Family income	Dummy
	Professional activity	Dummy
Consumers' attitudes	Statements agreement degree about peaches size, peaches waste, packaging use and PDO Calanda peaches quality	Ordinal number

Note: when each level of those variables was present it took value 1 and 0 otherwise.

3.A) Relationship among variables

Table 3.6 shows the results of relationships among variables dealing with consumers' habits towards PDO Calanda peaches' consumption and socio-demographic variables. For example, the null hypothesis or no existence of relationship among PDO Calanda peaches' consumption frequency and storage period, consumers' age, education level, family income and buyer activity are rejected at statistical significance of 1%; and among PDO Calanda peaches consumption frequency and, brand loyalty and family size, are rejected at statistical significance level of 5%.

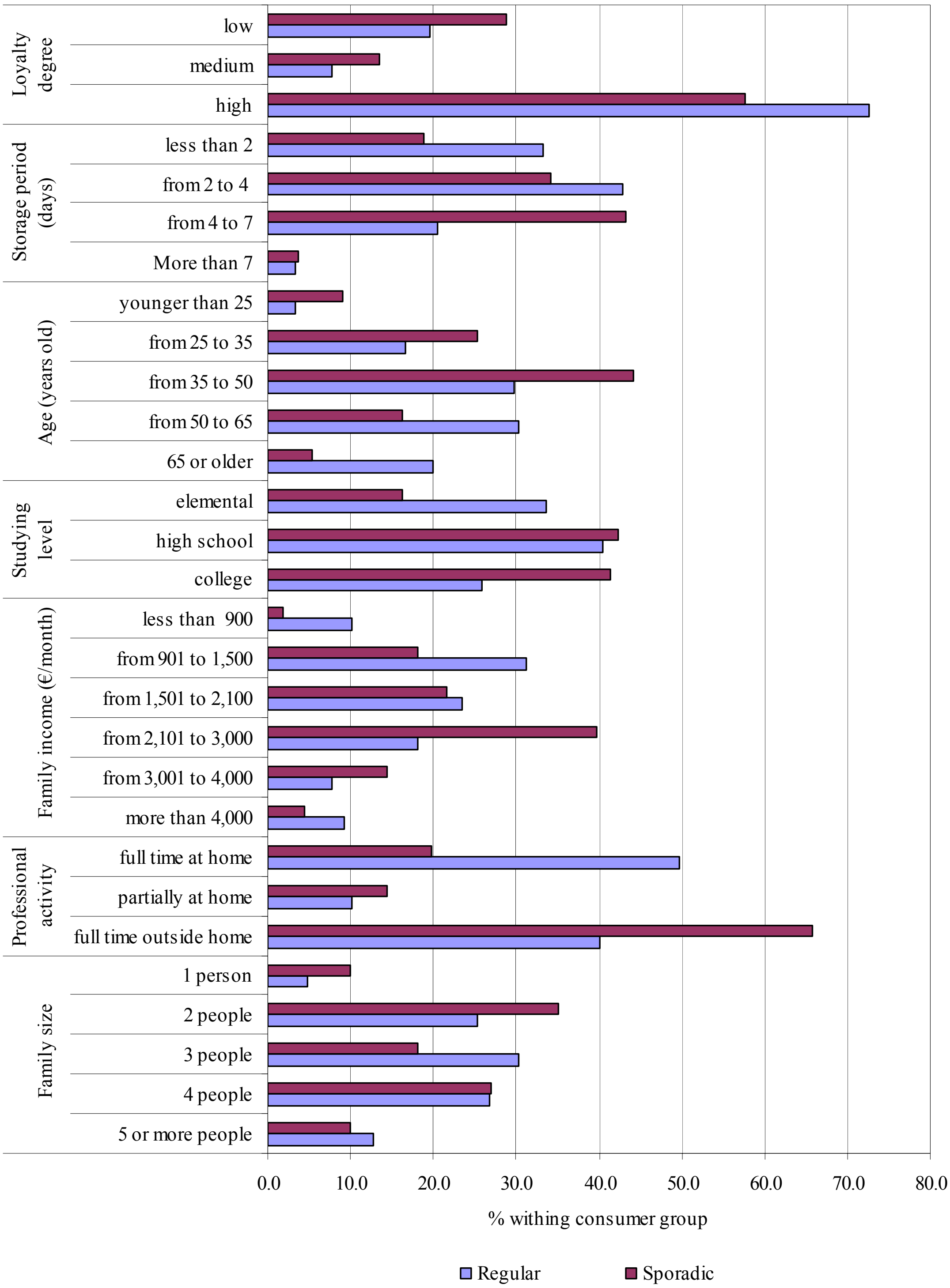
Table 3.6 Relationships among consumers' attitudes and socio-demographic characteristics, survey of 2008.

Variable group	Variables	*Consumers' habits and behave towards PDO Calanda peaches* 1	2	3	4
Consumers' habits and behaviour towards PDO Calanda peaches	Consumption frequency (1)				
	Loyalty degree (2)	**			
	Storage place (3)	ns	ns		
	Storage period (4)	***	ns	***	
Socio-demographic characteristics	Gender	ns	ns	***	**
	Age class	***	ns	***	*
	Studying level	***	**	ns	ns
	Family income	***	ns	ns	*
	Professional activity	***	*	**	ns
	Presence of teenager	ns	ns	ns	ns
	Presence of children	ns	ns	ns	ns
	Family size	**	ns	ns	*

Note: *** p-value ≤ 0.01; ** 0.01 < p-value ≤ 0.05; * 0.05 < p-value ≤ 0.1; and ^{ns} 0.1 < p-value

Graphic 3.8 presents the description of those variables that have statistical dependence with consumption frequency of PDO Calanda peaches. As defined in the previous section, regular consumers are those people who consume PDO Calanda peaches at least once a week and sporadic consumers are those who consume the product less than once a week.

Graphic 3.8 PDO Calanda peaches regular and sporadic consumers characteristics, in 2008



After PDO Calanda peaches have been purchased, regular consumers store them less time than sporadic consumers. About 33% and 18.9% of regular and sporadic consumers, respectively, eat PDO Calanda peaches after storing them at most for 2 days. The percentage of regular consumers that eat peaches between the 2nd and 4th day is 43% whereas for sporadic consumers is 34%.

Regular consumers tend to be more loyal to PDO Calanda peaches than sporadic consumers. In total, 72.7% and 57.7% of regular and sporadic consumers, respectively, have high loyalty degree, that is, they would not buy stone fruit if they don't find PDO Calanda peaches in the market. The percentage of regular consumers that would buy another peach (with low loyalty degree) is 19.5% and this percentage for sporadic consumers is 28.8%.

Sporadic consumers have higher education level and are younger than regular consumers. On average, 33.7% of regular consumers have just elementary studies and 25.9% have university education, for sporadic consumers these percentages are 16.2% and 41.4%, respectively. Regarding age, there is a greater sporadic consumers percentage in every age class until 50 years old. Sporadic consumers are concentrated mainly from 35 to 50 years old and regular consumers are gathered from 50 to 65 years old. There are also a greater proportion of regular consumers who are 65 or older, which means that there are more people who are retired among regular consumers.

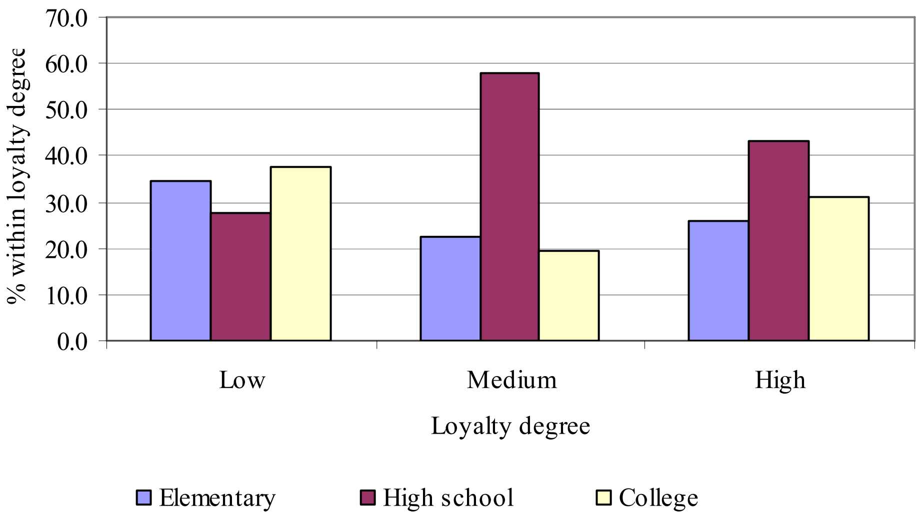
Considering that retired people dedicate their time mainly to household activities and that the regular consumer group has a higher proportion of people who are 65 or older (retired people), it may explain the difference between professional activities of regular and sporadic consumers. For 19.8% of the sporadic consumers, they are dedicated full time at home in contrast of fewer (49.8%) regular consumers. For sporadic consumers, in 65.8% of cases, their professional activities are full time outside household while the same happens for 40.0 % of regular consumers. Their activities affect their family income.

Although the market for PDO Calanda peaches has been increasing more than other peaches, regular consumers belong more to lower income families than sporadic. There are more regular consumers (64.9%) in families with lower income levels than 2,100€/month than sporadic consumers (41.4%) and there are more sporadic consumers (58.6%) in families that get more than 2,101€/month than regular ones (35.1%).

With regard to family size, there are more sporadic consumers (45.0%) in families with 1 person (they live alone) or 2 people (they share home with another person) than regular consumers (30.2%) and there are more regular consumers (30.2%) in families with three people than sporadic consumers (18.0%). It implies that in relation to sporadic consumers, regular consumers' household income per capita decreases, even though they prefer higher price peaches with higher quality.

Table 3.6 shows that consumers' loyalty degree towards PDO Calanda peaches varies according of how often they consume PDO Calanda peaches (described in Graphic 3.8) and their education level, at least with 5% of statistical significance. Graphic 3.9 describes the consumers' education level according to their PDO Calanda peaches loyalty degrees.

Graphic 3.9 Consumers education level according to PDO Calanda peaches loyalty degree, in 2008

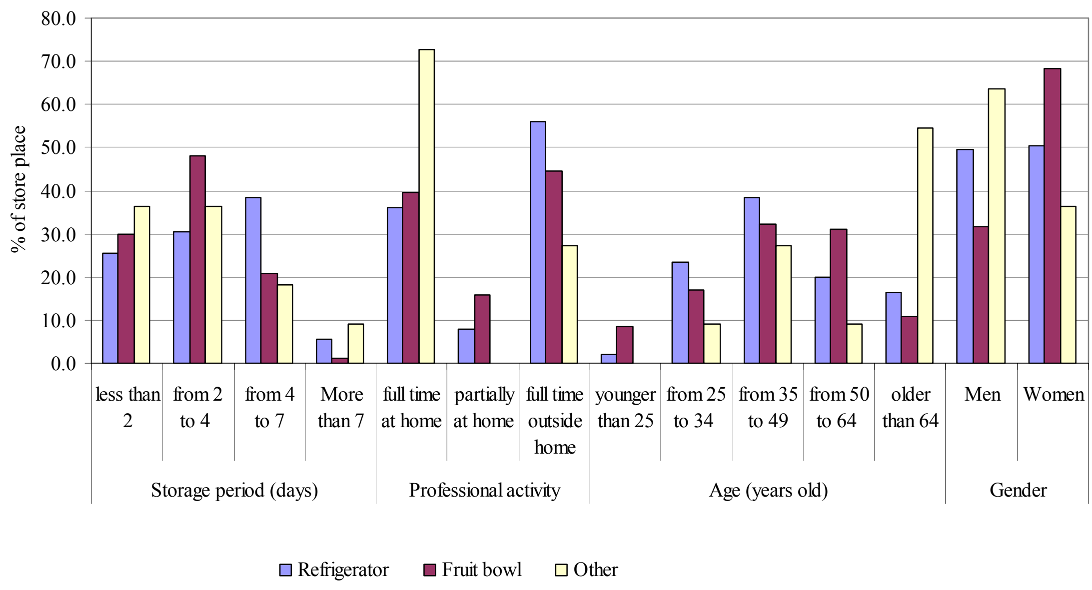


Different loyalty degrees have different education structure.Given that data were coded as dummy variables, it was not possible to determine what kind of relation exist (for example, if it is monotonous or not) between education level and loyalty degree.. However, basing on Graphic 3.9, it is possible to see that consumers with lowest loyalty degree have highest percentage of people who studied in college as well highest percentage of people with elementary education. People with medium loyalty degree have the greatest percentage of consumers that attended high school. Individuals with high school also correspond to the highest percentage of PDO Calanda peaches with highest loyalty degree.

In chapter 2, the importance of storing peaches to get a product with good final quality has been dealt. Here, where consumers store peaches at their home and for how long is analyzed. Chi-square tests show that there is a statistical significant relationship between PDO Calanda peaches storing places and consumers' gender, age, buyer activity and storage period. Consumers' characteristics of each storage place are described in Graphic 3.10.

Women are more likely to store PDO Calanda peaches in fruit bowls than men. There is greater proportion of women (68.3%) who maintain peaches in fruit bowls than men (31.7%) and the percentage of men and women are the same, around 49.6% when considering peaches stored in refrigerators. Men are the majority part of consumers (63.6%) who store PDO Calanda peaches in other places.

Graphic 3.10 Consumers' characteristics according to PDO Calanda peaches store places



Most of consumers who store PDO Calanda peaches in other places are older than 64 years, and consumers who put peaches in refrigerators are younger than those consumers that store peaches in fruit bowls, even though there are less people younger than 25 years old. The average age of consumers who store peaches in refrigerators seem to have between 35 to 49 years old while those who store in fruit bowls is between 35 to 64 years old.

Consumers professional activities of those who store PDO Calanda peaches in refrigerators, are essentially full time outside home (56.0%) and the activities of those who store peaches in fruit bowls is distributed between full time outside home (44.5%) and full time at home (27.3%).

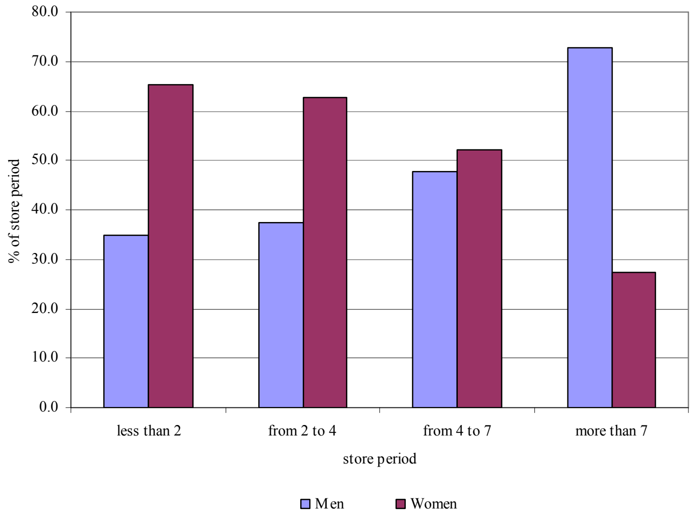
Graphic 3.10 also shows, for each store place, the percentage of consumers who store PDO Calanda peaches in different periods of time. Consumers who store peaches in other places are more extreme because they are more concentred in first class (consuming peaches before the 2nd day) and the last class (wait more than 7 days to eat peaches). Comparing these results between the two most important store places, refrigerators and fruit bowls, consumers tend to store peaches for longer periods in refrigerators, which is not a recommended place. For long periods (more than 4 days) the most appropriate place would be the fruit bowl[5].

Storage periods as well as storage places are statistically related with PDO Calanda peaches consumption frequency and with consumer gender, age, their strategy of eating big peaches, family income and family size (see Table 3.6). Its relationship with consumption frequency is presented in Graphic 3.8; its association with storage place is shown in Graphic 3.10 and with other features is arranged in Graphic 3.11.

The relationship between PDO Calanda peaches storage time and male percentage is positive. Results show that 34.8% of consumers who eat peaches before the 2nd day after purchasing are men and this percentage increases with store period up to 72.7% for those male who store peaches at home for longer time than a week.

[5] According to Crisosto (2007) peaches can suffer changes (chilling injury) when stored at range of temperatures between 2 and 7 º C, which is called "death range"; this temperature range tend to be prevalent in refrigerators, and therefore is not an appropriate place to store peaches for long time.

Graphic 3.11 PDO Calanda peaches consumers gender according to store period



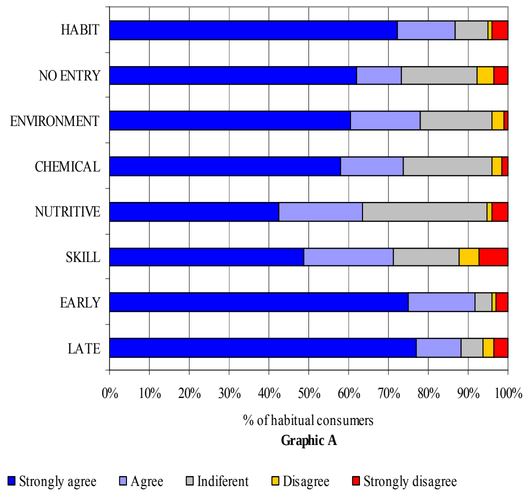
3.B) Rating scale comparison between regular and sporadic consumers

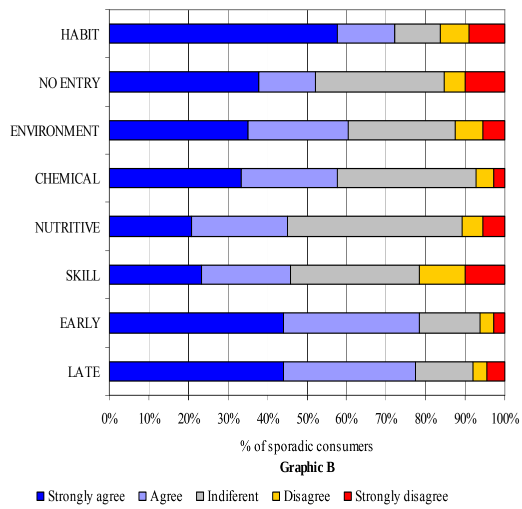
The second parts of bivariate analyses are comparisons between statistically different ratings in relation to different claims of PDO Calanda peaches consumption. Consumers were divided in two groups, regular and sporadic consumers. Their responses (scores) were compared according to U of Mann-Whitney test. Only variables that are statistically different between these two groups of consumers are presented in graphics A and B from Graphic 3.12.

Graphic A shows the ratings of regular consumers of PDO Calanda peaches and graphic B shows the ratings of sporadic consumers. Higher percentages (72.2%) of regular consumer strongly agree that they have eaten peaches since their childhood, while for sporadic consumers this percentage is 57.7%. It means that eating peaches in the past (since childhood) determines higher demand of PDO Calanda peaches at present.

A higher fraction of regular consumers strongly agrees that “buying PDO Calanda peaches prevents selling peaches from other areas, which promote the local economy and it would benefit them”. In total, there is 62.0% and 37.8% of regular and sporadic consumers, respectively, who strongly agree with this statement. This means that consumers who eat more often PDO Calanda peaches feel more benefits by promoting local product consumption than consumers who eat less often PDO Calanda peaches.

Graphic 3.12 Degree of agreement of consumers to statements with respect to the consumption of peaches, in 2008





Regular consumers are more confident about PDO Calanda peaches quality than sporadic consumers. Thus, 60.5% of regular consumers strongly agree that buying PDO Calanda peaches improve the environmental quality in the production area because the employment of cleaner production techniques, while 35.1% of sporadic consumers also think so. There is also higher percentage (58.0%) of regular consumers than sporadic consumers (33.3%), who strongly agree that PDO Calanda peaches are healthier because less fertilizers and chemistry are used in their productions, than those peaches not produced under PDO Calanda's specifications.

Although there is smaller part (42.4%) of regular consumers who strongly agree that PDO Calanda peaches are more nutritious than other peaches, however it is much higher percentage than sporadic consumers (20.7%). The percentage of both consumers groups (31.2% for regular consumers and 44.1% for sporadic consumers) who do not express their opinions is very high.

Regular consumers of PDO Calanda peaches consider themselves more preferred to identify the best quality peaches. Practically half (48.8%) of these consumers strongly agree that they are able to perfectly identify those peaches which the best quality and taste. On the other hand, only 23.4% of sporadic consumers strongly agree that they are able to identify the best quality and good tasty peaches.

PDO Calanda peaches consumption frequency also interferes with the view of expanding the supply season of PDO Calanda peaches. If there is not a change of PDO Calanda peaches quality, 75.1% of regular consumers strongly agree to anticipate the supply season of PDO Calanda peaches and 77.1% of regular consumers strongly agree to delay the season through November and December. Sporadic consumers strongly agree, in 44.1% of cases, to anticipate supply and the same percentage strongly agree to extend the offer in November and December.

Even having different desires of expanding PDO Calanda peaches supplying time, regular and sporadic consumers are indifferent towards anticipating or delaying supply. In both cases, the agreement levels of adopting these two strategies are almost the same.

3.3.2 Survey of 2009

In 2009, it was carried out a new survey to complement the previous one. Some new questions and tasks were introduced and some questions were repeated to check the consumers' preferences stability. Some other questions were phrased in a different way in order to simplify the questionnaire. The number of options for questions like PDO Calanda consumption frequency and place of purchase was reduced. The question about substitute fruits (to measure consumers' loyalty degree) changed from an open question to a closed question with 5 options.

The 2009 questionnaire can be found in Appendix 2, for the English version, and Appendix 4, for the Spanish (original) version. It has three parts. The first one assesses consumer attitudes towards PDO Calanda peaches consumption, the second part corresponds to two choice experiments, that won't be presented in this section, and the last part deals with consumers' socio-demographic information. As socio-demographic information had no significance difference (using chi-square test) between both surveys, the socio-demographic information from survey of 2009 won't be presented.

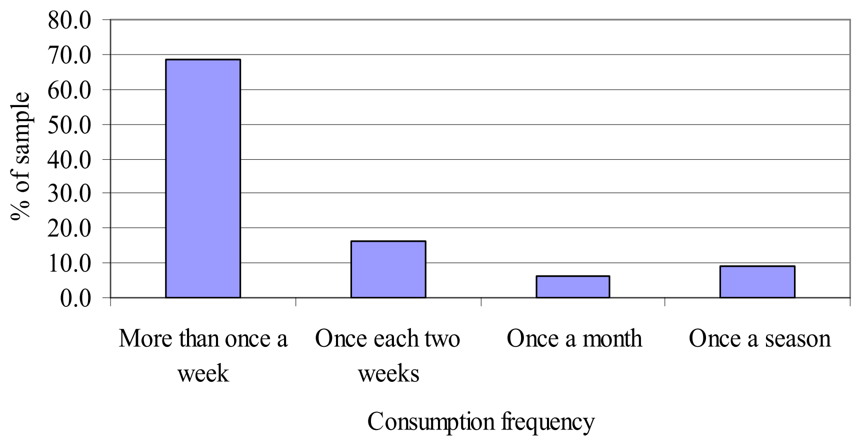
3.3.2.1 Univariate Analysis

3.A) PDO Calanda peaches consumers' attitudes

PDO Calanda peaches consumption frequency in 2009 was very similar to consumption frequency in 2008 and differences are no statistically significant. Graphic 3.13 shows that almost two thirds of PDO Calanda peaches consumers eat more than once a week, 16.5% eat once each two weeks, 6.1% have once a month and the rest only once in the entire season. In this sense, regular consumers in 2009 were 68.4% of PDO Calanda peaches consumers and sporadic consumers represented only 31.6%.

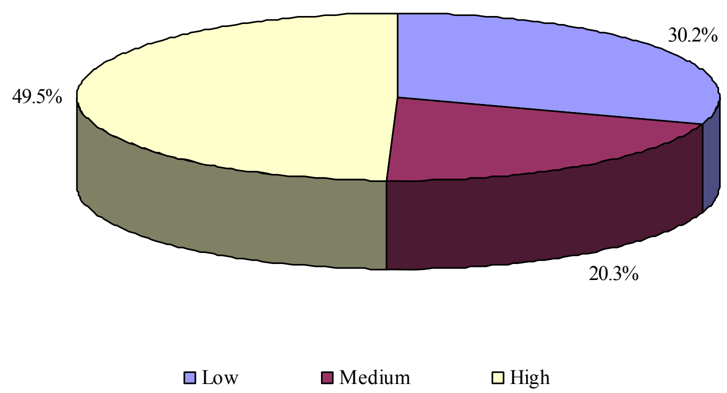
The fourth question in the questionnaire, measured the consumers loyalty degree toward PDO Calanda peaches, so it asked to consumers which fruit would buy if there were not PDO Calanda peaches available in the market. Out of total consumers, 30.2% choose other peaches, 20.3% buy nectarines as substitutes, 17.5 prefer oranges or nectarine (citrus), 16.0% like apples or pears and the rest (16%) purchase melons. Thus, it is estimated that 30.2% of consumers have low loyalty degree toward PDO Calanda peaches, 20.3% have medium loyalty degree and 49.5% have high loyalty degree. Responses of the consumers' loyalty degree to PDO Calanda peaches are shown in Graphic 3.14.

Graphic 3.13 PDO Calanda peaches consumption frequency in Zaragoza city in 2009



As mentioned earlier, in 2009 consumers had to choose among 5 options for substitute products, while in 2008 they could mention any fruit and this change provided different results. The low loyalty degree of 2008 increases from 22.8% of consumers to 30.2% in 2009. But the greatest difference is found in medium loyalty degree that improves from 9.8% to 20.3% of consumers.

Graphic 3.14 Consumers' loyalty degree toward PDO Calanda peaches in 2009

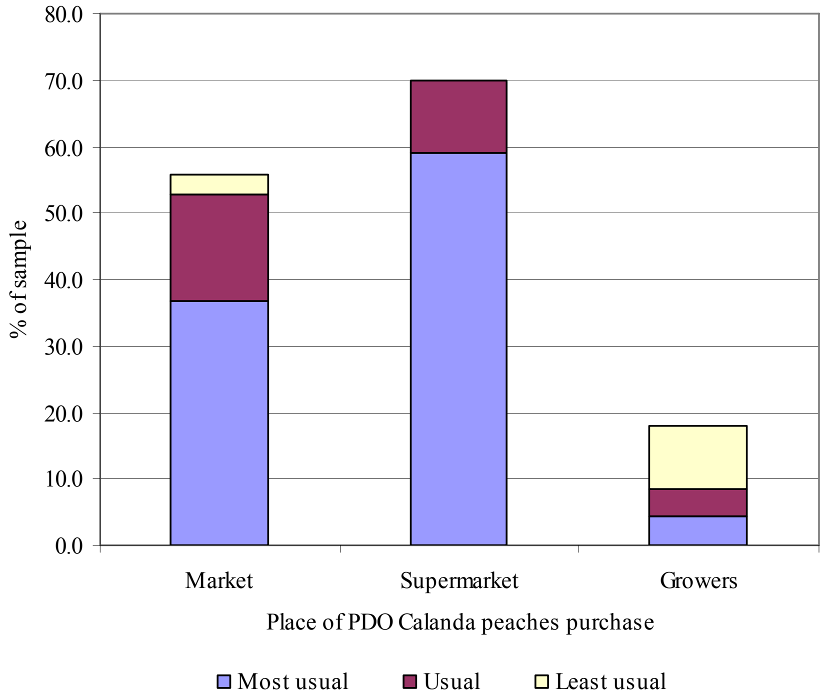


Consumers were asked to order, according to the frequency, three options of purchase places of PDO Calanda peaches. If they did not use to buy PDO peaches, in a particular place, they left the option in blank. Graphic 3.15, shows the results and in 2009 consumers mostly (69.8% of them) buy PDO Calanda peaches in supermarkets (it includes supermarket and hypermarket) and it is followed by markets (55.7%) and growers (17.9%). Markets grather outlets such as fruit stores and traditional street markets. Consumers, in 59.0% of cases, stated that they shop PDO Calanda peaches mainly in supermarkets and 36.8% mainly in markets. According to MMAMRM (2010a), 59.0 % of peaches in Spain are sold in supermarkets and hypermarkets, in 2009, and the percentage is exactly the same as the main purchase place for PDO Calanda peaches in this survey.

Comparing results of purchase places of PDO Calanda peaches in both surveys, there are differences statistically significant, at 1% of confidence. In the 2008 surveyed consumers declare that their main place to buy PDO Calanda peaches is in markets while in 2009 is at supermarkets. This difference may be explained because the questions were proposed differently, but in both cases results are close to MMAMRM (2010a) data.

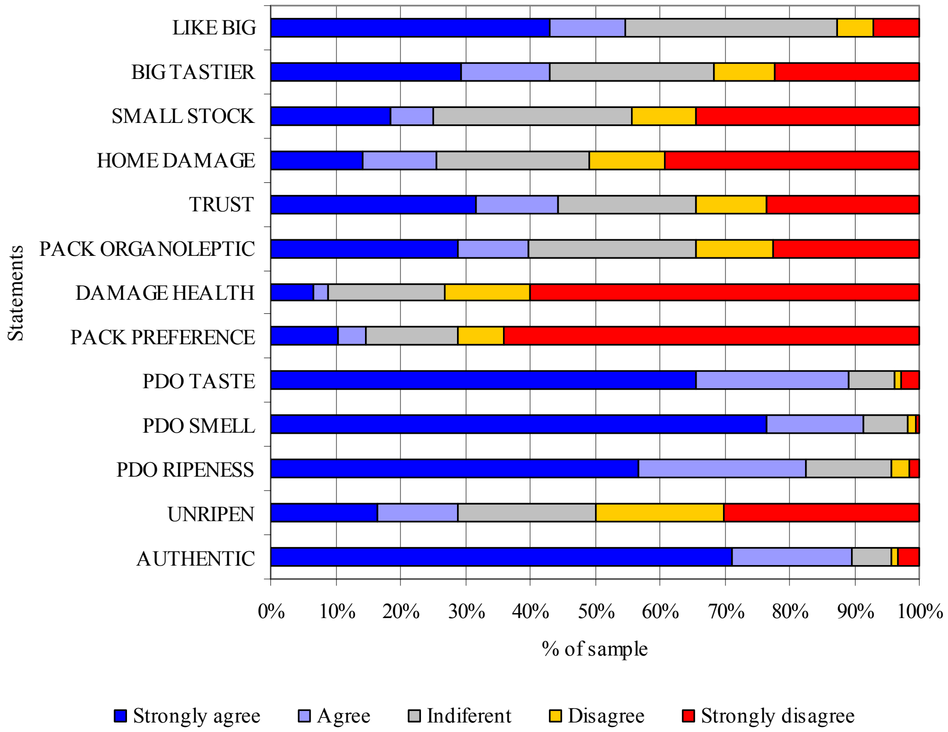
Research also assessed consumers' attitudes in relation to PDO Calanda peaches quality aspects, consumption habits and food safety by using Likert scales. In this scale, consumers scored 5 if they strongly agreed with statements, and they scored 1 if they strongly disagreed and if they neither agreed nor disagreed with statements they scored 3 (in the graphic it is represented as "indifferent").

Graphic 3.15 PDO Calanda peaches purchase places in 2009



In total, each consumer scored 13 statements. To simplify results, statements are defined as follow: "I like very big size peaches" is LIKE BIG, "big size peaches taste better" is BIG TASTIER, "small size peaches can be stored less time" is SMALL STOCK, "peaches with PDO Calanda have excellent taste" is PDO TASTE, "peaches with PDO Calanda smell very well" is PDO SMELL, "peaches with PDO Calanda have optimal ripeness" is PDO RIPENESS, "I pay more for a PDO brand because I know it is authentic" is AUTHENTIC, "I prefer not ripen peaches" is UNRIPEN, "at home, peaches damage quickly" is HOME DAMAGE, "packaged peaches taste and smell the same" is PACK ORGANOLEPTIC, "I do not trust long live peaches" is TRUST, "packaged fruit damages health" is DAMAGE HEALTH, and "I have little time, so I prefer packaged fruit" is PACK PREFERENCE. Results of these statements evaluations are shown at Graphic 3.16.

Graphic 3.16 Consumers' agreement degree about peaches statements, in 2009



In the Graphic 3.16, the first three statements are about consumers' quality perceptions of the largest peach. First assertion is that consumer like large peaches (it was shown a piece about 380g to guide them about how the largest peach was). Consumers prefer large and medium peaches. Results stay that 42.9% of consumers strongly agree (corresponding to those who like large peaches), 32.5% neither agree nor disagree (they are those who like medium size peaches), and only 7.1% strongly disagree with the statement (they are those who prefer small peaches).

The second statement attempts to justify preferences for large peaches of the previous statement. Results show that 29.2% of consumers strongly agree that large peaches taste better than small, 22.2% of consumers strongly disagree with the statement and 25.5% of consumers neither agree nor disagree.

The third statement also attempts to explain aspects related to preferences of large peaches. In general, 18.4% of consumers strongly agree that small peaches loose more their quality while stored at home, 34.4% strongly disagree with this statement and 30.7% of consumers neither agree nor disagree with it. Comparing answers between the 2nd and 3rd statements, consumers prefer more large peaches because consumers believe they are tastier.

The next point deals with consumers' perception of peaches waste at home. Results show that 14.2% of consumers strongly agree that peaches soon deteriorate in their homes, 23.6% indicate moderate losses of peaches in their home because they neither agree nor disagree and a great part (39.2%) of consumers strongly disagree with the statement, which means they have no serious problems with wasting peaches when stored at home.

Modified or protective packaging atmosphere could improve peaches conservation. In this sense next statement was "I do not trust packaged peaches with long shelf life" (TRUST). The percentage of consumers who strongly agree is 31.2%, 23.6% declares that they strongly disagree and 21.2% neither agree nor disagree with this statement.

One possibility to reject the use of packaging is the consequences on organoleptic characteristics changes. Thus, 28.8% of consumers agree that peaches sold in packing have the same smell and taste than peaches in bulk, 22.6% strongly disagree, that is, they consider that packages change peaches taste and smell and 23.6% neither agree nor disagree with that statement. A considerable amount of consumers (23.6%) believe that packing can change peaches' organoleptic quality, but this change may not represent a serious problem.

Packaging fresh peaches may be perceived by consumers as something harmful to health because the product loses the natural benefits. But according to responses, 59.9% of PDO Calanda peaches consumers do not believe that packing fresh peaches would have consequences to health and only 6.6% strongly agree with it.

Convenience is one of the reasons that led consumers to desire packaged food when they are shopping. According to responses, 64.2% of consumers do not asign the lack of time for shopping as a reason of prefering (they strongly disagree) fresh packed fruit. Only 10.4% strongly agree that they have less time and therefore they would prefer fresh packaged fruit.

Based on comments from consumers who participated in the survey of 2008, that they declared that PDO Calanda peaches didn't have same quality as 30 years ago (they referred to traditional peaches from Calanda area), the 2009 survey incorporated three statements about PDO Calanda peaches quality, such as ripeness and organoleptic quality (taste and smell). The purpose was to identify the consumer satisfaction degree with PDO Calanda peaches.

According to survey results, consumers are very satisfied with PDO Calanda peaches taste. With regard to taste, there was the statement "peach taste is unbeatable for PDO Calanda peaches". In this sense, 65.6% of consumers strongly agree and 23.6% agree. Only 3.8% of consumers disagree or strongly disagree.

Consumers' satisfaction in relation PDO Calanda peaches smell is even higher than satisfaction with its taste. In total, 76.4% of consumers strongly agree and 15.1% agree that PDO Calanda peaches smell good and only 1.9% are dissatisfied (strongly disagree or disagree) with PDO Calanda peaches smell. Consumers are also very satisfied with PDO Calanda peaches ripeness. Overall 56.6% of them strongly agree that PDO Calanda peaches have optimal ripeness, 25.9% agree with it and just 4.2% disagree or strongly disagree.

The 2009 survey also included a statement about consumers' preference for unriped peaches. The idea was to know how many consumers would like a product ready to eat (ripen peach) and a product that can be stored for longer time at home (they would wish unripe peaches). Results indicate that consumers prefer more ripen peaches or ready to eat. The percentage of consumers that strongly disagree that they prefer unripe peaches is 30.2% and those who agree represents 19.8%, i.e., they prefer ripen peaches to unripe ones, 21.2% neither agree nor disagree with the statement, they prefer peaches in intermediate ripeness stage. Those consumers who prefer unripe peaches represent 28.8% (16.5% strongly agree and 12.3% agree with the statement).

3.3.2.2 Bivariate analysis

Bivariate analysis is used to study the relationship or dependence degree between two variables (Pedret *et al.*, 2000). In this study, it has been used the Chi-square test and the U test of Mann-Whitney. Chi-square is used to estimate if there are relationships between two variables. The chi-square statistic of Pearson is calculated, which contrasts the hypothesis of no dependence between qualitative variables. Not only dicotomic characteristics, such as gender, presence of chikdren and presence of teenagers in the household, but other characteristics that were classified in levels or classes such as consumption frequency, loyalty degree, age, education level, family income and professional activity were analised as qualitative variables. These qualitative variables were coded as dummy. For example, variable took value 1 if consumer was from a specific class of age and it took value 0, otherwise. It was not took into account that some variables (consumption frequency, loyalty degree, age group, education level and family income) could be coded analysed as ordinal variable because they were also analysed as dummy variables in interaction models, between consumer and product feature, delt in the Chapters 4, 5 and 7, as mentioned earlier.

For ratings tasks, Likert scale variables are considered as ordinal numeric variables (ordinal variables also are listed in Table 3.7, as well all variables) and they are analysed with the U of Mann-White test. This statistic deals with nominal and ordinal variables (ranking). The null hypothesis is that mean ranges for groups are equally distributed.

Table 3.7 Variable classification

Variable group	Variable	Type of variable
Consumers' habits and behaviour toward PDO Calanda peaches	Consumption frequency	Dummy
	Main place of purchase	Dummy
	Loyalty degree	Dummy
Socio-demographic	Gender	Dummy
	Age group	Dummy
	Education level	Dummy
	Family size	Dummy
	Presence of children	Dummy
	Presence of teenagers	Dummy
	Family income	Dummy
	Professional activity	Dummy
Consumers' attitudes	Statements agreement degree about peaches size, peaches waste, packaging use and PDO Calanda peaches quality.	Ordinal number

Note: when each level of those variables was present it took value 1 and 0 otherwise.

3.A) Relationships among variables

Table 3.8 shows the results of relationships among variables of consumers' habits toward PDO Calanda peaches consumption and socio-demographic variables. For example, the null hypothesis or no existence of relationship among PDO Calanda peaches consumption frequency and consumers' age, family income and professional activity are rejected at statistical significance 1%. But the relationship between PDO Calanda peaches consumption frequency and education level is rejected at statistical significance level of 5%; and relationship between PDO Calanda peach consumption frequency and PDO Calanda peaches loyalty degree is rejected at statistical significance level of 10%. And, in the case of the main place for PDO Calanda peaches purchase, this variable shows relationship only with storage period at statistical significance of 1%.

Table 3.8 Relationship between the parameters of attitudes and socio demographic consumers' characteristics, in 2009

Variable group	Variables	Consumers' habits and behaviour toward PDO Calanda peaches	
		1	2
Consumers' habits and behaviour towards PDO Calanda peaches	Consumption frequency (1)		
	Loyalty degree (2)	*	
Consumers' socio-demographic characteristics	Gender	*	*
	Age class	***	ns
	Education level	**	***
	Family income	***	ns
	Professional activity	***	ns
	Teenagers	ns	ns
	Children	ns	ns
	Family size	ns	ns

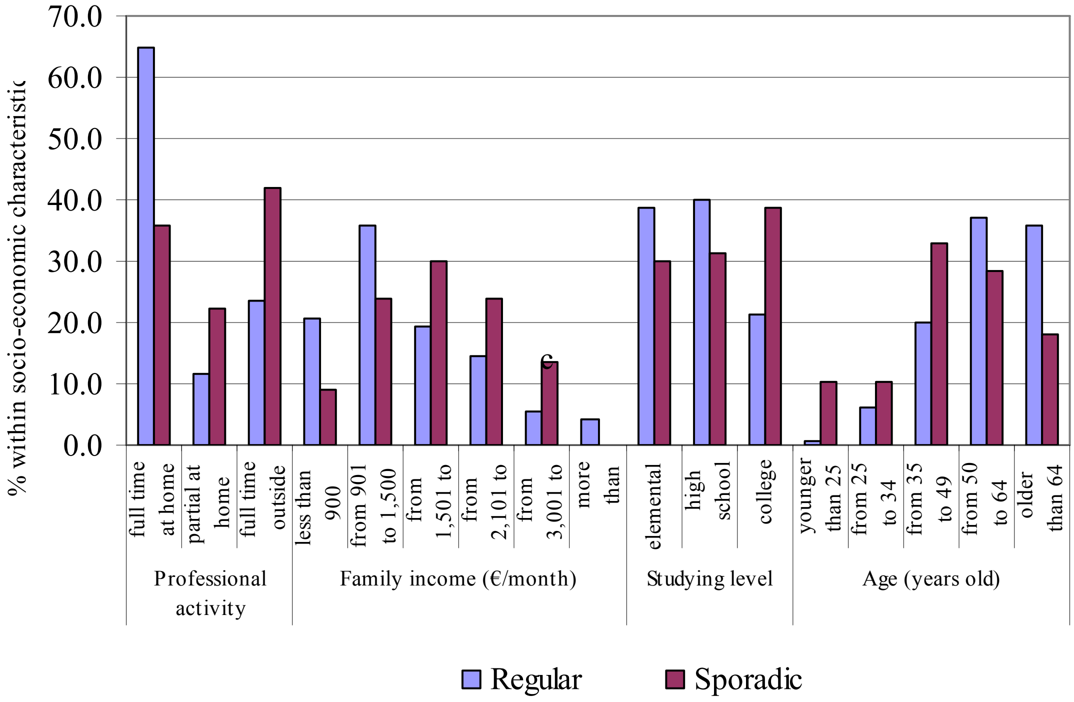
Note: *** p-value ≤ 0.01; ** 0.01 < p-value ≤ 0.05; * 0.05 < p-value ≤ 0.1; and ns 0.10 < p-value

Although consumers' loyalty degree toward PDO Calanda peaches has a relationship with PDO Calanda peaches consumption frequency, as well consumers' gender with PDO Calanda peaches consumption frequency, this statistical significance is at 10% of confidence. Graphic 3.17 describes those consumers characteristics that have greater statistically significance than 5% of confidence.

Regular consumers are older than sporadic. Up to 50 years old, every age class of consumers has higher percentage of sporadic consumers. This situation changes and there are higher percentages of regular consumers on consumers over 49 years old.

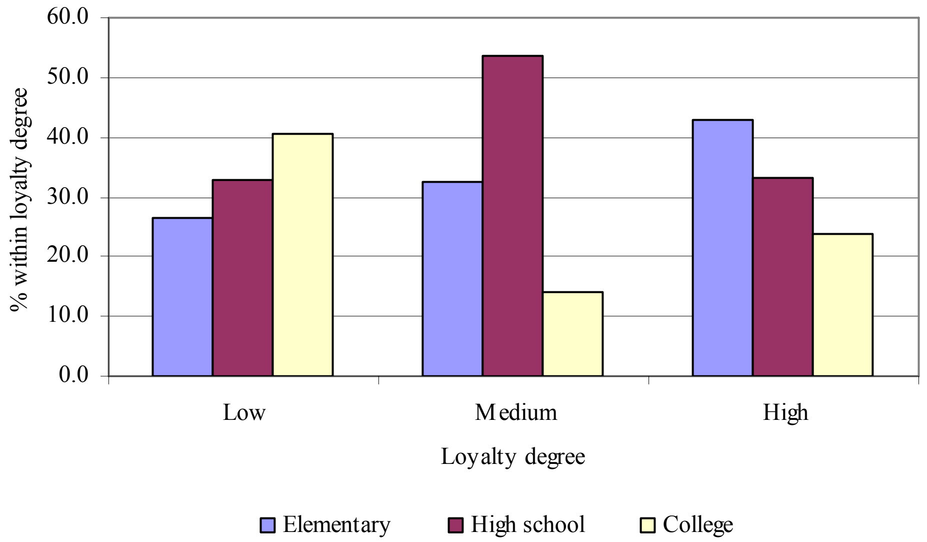
Regular consumers are people with lower education level than sporadic, 38.6% of them have elementary education, 40% high school and 21.4% with college degrees, while percentages for sporadic consumers are 29.9%, 31.3% and 38.8%, respectively. Monthly households' income of regular consumers are smaller than sporadic. There are 20.7% of regular consumers' families that get less than 900 Euros per month and this proportion for sporadic consumers' families is 9.0%. Sporadic consumers have higher weight in income levels between 1,501 and 4,000 Euros per month.

Graphic 3.17 PDO Calanda peaches regular and sporadic consumers characteristics, in 2009



Relationship is found in the survey of 2009, between PDO Calanda peaches loyalty degree and consumers education level (Graphic 3.18). Both surveys have the greatest proportion of consumers of medium loyalty with high school education, which reach 76.7% in 2009. Although it is not found any tendency between education level and loyalty degree in 2008, in 2009 it seems to have a positive relationships between education level and consumers' loyalty degree. The plausible explanation of this divergence is the different question about what kind of fruit they would buy if PDO Calanda peaches were not available in the market.

Graphic 3.18 Characteristics of consumers according to their degree of loyalty towards PDO peach Calanda, in 2009

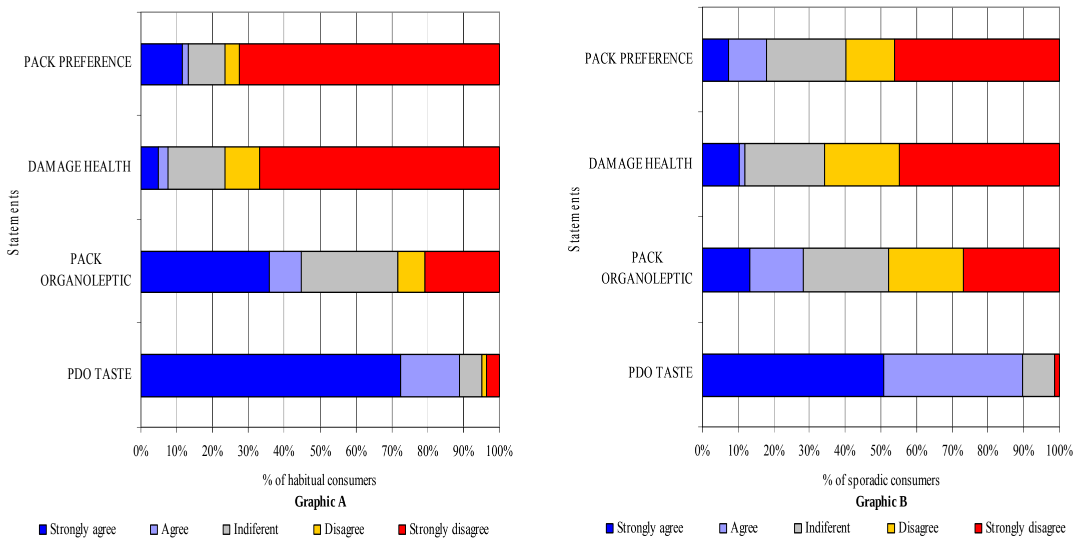


3.B) Rating scale comparisons between regular and sporadic consumers

The second part of the bivariate analysis presents comparisons between ratings in relation to different claims of PDO Calanda peaches consumption. Consumers were divided in two groups, regular and sporadic consumers. The consumers' responses (scores) were compared according to the U of Mann-Whitney test. Only variables that are statistically different between these two groups of consumers are presented in the graphs A and B of Graphics 3.19.

Sporadic consumers of PDO Calanda peaches have higher preferences for packaged fresh fruit than regular consumers because they have less time to go shopping. Sporadic consumers, who strongly disagree with the statement that they have little time and then they would prefer packaged fresh fruit, is 46.3% and for regular consumers this percentage increases to 72.4%.

Graphic 3.19 Degree of agreement of consumers to statements with respect to the consumption of peaches in 2009



Although sporadic consumers have higher preference for packaged fruit, greater proportions of them also believe that packaged fresh fruits may harm health. Graphic 3.19 shows that 44.8% of sporadic consumers strongly disagree that packaged fresh fruits could have negative consequences on health (Graphic B) and this percentage increased to 66.9% for ordinary consumers (Graphic A).

Although sporadic consumers believe that packaged fresh fruit market may be more detrimental to health, regular consumers don't think that packaging affects organoleptics qualities of peaches. Sporadic consumers who consider that peaches' taste and smell may undergo changes reaches 28.4%, while 44.8% of regular consumers think the same (35.9% of regular consumers strongly agree with this idea). Consumers who disagree with the statement that packages change the taste and smell of fruit has been 20.9% of sporadic consumers and the 7.6% of regular consumers.

Next issue is about the different points of view to improve PDO Calanda peaches taste comparing regular and sporadic consumers. Consumers who think PDO Calanda peaches taste may be improved are those who are less satisfied with this aspect than those consumers who think PDO Calanda peaches can not be improved. In this sense, Graphic 3.19 shows that regular consumers are more satisfied with PDO Calanda peaches taste than sporadic consumers. Regular consumers strongly agree (72.4%) that PDO Calanda peach taste is unbeatable and 16.6% strongly agree or agree that can be improved. Sporadic consumers who strongly agree that PDO Calanda peaches taste is unbeatable are 50.7% and those who agree or strongly agree that taste could be better are 38.8%.

3.4 Final Remarks

Two surveys were conducted to study consumers' preferences for PDO Calanda peaches in Zaragoza city, in 2008 and in 2009. Both polls have acceptable sampling error (5.6 to 6.9%) and they can be considered as representative of Zaragoza's population.

This chapter has described consumers' socio-demographic features and they have been compared with census information of Aragon's population. The socio-demographics characteristics of both surveys are very similar. These results were expected because the samples have been made in the same manner and from the same population: PDO Calanda peaches' consumers.

Women are the largest proportion of PDO Calanda peaches' consumers, with an educational level slightly above the Aragonese average and their professional activities are full-time outside home. The monthly households' income distribution is more focused on the middle income classes than considering all representative households of Aragon.

During the PDO Calanda peaches marketing season, around 2/3 of consumers eat them at least once a week. Sample consumption of PDO Calanda peaches is about 25% above the average consumption in Zaragoza city in 2008, which has been estimated in 210g/week.

Variables related to consumption frequency of PDO Calanda peaches are consumers' characteristics, such as, age, education level, household income and professional activity reinforced by consumers' attitudes towards the PDO, such as, quality perception and loyalty degree.

A regular consumer, who is defined as a person who eats PDO Calanda peaches more often than once a week, is characterized to be more than 50 years old and to have a lower educational level and household income than a sporadic consumer (who consumes PDO Calanda peaches less often than once a week) and he is dedicated to full-time home activities in a higher proportion than an average person representative of the entire population. This finding is relevant because it indicates that although PDO Calanda peaches are considered by consumers (Focus Group) as high price fruits, price might not be restraining its consumption.

Consumers' age determines eating habits for several reasons. One is that when a person grows older he becomes more concerned about his health and may change his preferences to healthier foods. Another factor is the eating culture because regular consumers answers, in higher proportion say, that they have been eaten peaches since their childhood. This feature is very important because government policies promoting healthy eating at schools could have positive effects on PDO Calanda peaches' demand in the long term.

Another reason is the consumer professional activity. Older people are more engaged in household activities and they have higher fruit consumption. It is also important to consider the peach skin fuzziness because it invites consumers somehow to use knife to peel it off and it can limit peaches' consumption outside home. New packing preservation can increase peaches' convenience and it can solve this problem.

Although new packing increases product quality (objective quality), by increasing the conservation period or making its consumption easier, consumers can perceive that peaches quality decreases. According to survey results, few consumers believe that packing fresh fruit may affect negatively their health and the risk perception for regular consumers is lower than for sporadic consumers. On the other hand, regular consumers also think that packed peaches during a long time has negative effects on their taste and smell.

Peaches with a longer preservation period are an interesting option to increase fruit consumption among sporadic consumers. These kinds of consumers considers that packing will change neither taste nor smell, as in most cases they work outside home and they store PDO Calanda peaches at home for longer period of time. However, it is necessary to provide them with more information about packing consequences on their health.

Touching peaches is another aspect of risk buying perception. At selling places many consumers touch peaches to assess peaches quality by its flesh firmness and to select those with higher quality. However, peaches can get spoilt when they are touched many times. In the survey, around 40% of consumers state that they dislike that other consumers touch peaches before buying them and this percentage decreases to about 20% if consumers wear gloves. It means that a great part of consumers consider that peaches are spoilt when they are sold in bulk and half of them think that peaches also can become infected. The packing benefits can be better recognised by this type of consumers.

In general, PDO Calanda peaches' consumers are satisfied with their quality. However, regular consumers are more satisfied than sporadic consumers when considering some peaches' aspects. For example, there is a higher proportion of regular consumers satisfied with PDO Calanda peaches taste. Regular consumers state that the particular PDO Calanda peaches production system impacts more positively the environment quality than conventional practices. Regular consumers also know that PDO Calanda peaches employ less fertilizer and pesticides, and as a consequence, the production system provides healthier fruit. These attitudes mean that taste satisfaction has a strong importance on consumption and there is a lack of knowledge among sporadic consumers about PDO Calanda peaches' benefits.

Regular consumers' skills to identify peaches quality, specially its ripeness, are higher than for sporadic consumers. Another finding is that sporadic consumers who store PDO Calanda peaches at home for longer time tend to store peaches more at their refrigerators. As mentioned in chapter 2, refrigerators have the worst temperature range to preserve peaches. Therefore, sporadic consumers need more information about peaches conservation and, at selling places, more information concerning peaches quality related to taste, ripeness and storage.

Regular consumers are more loyal than sporadic. Although there are some differences between surveys on loyalty degrees, in both cases regular consumers state that they would not buy another stone fruit if PDO Calanda peaches are not available in the market. Differences on loyalty degree can be explained by consumers' satisfaction. As mentioned earlier, regular consumers are more satisfied with PDO Calanda peaches quality.

PDO Calanda peaches have a short production season. Zaragoza consumers are aware that these peaches come at the end of the season and they link them with the city festivities, which happen in mid-October. Extending the marketing period could have extra benefits as greater presence and possibilities for better promotion. However, they will suffer competition from other peaches if production is anticipated. Altogether there is a risk of decoupling the image of the product with the region traditions.

Consumers express their agreement about anticipating and delaying supply of PDO Calanda peaches if quality is the same. The general opinion is that they are indifferent about the expansion of the marketing period and both regular and sporadic consumers indicate agreement with the two options. Nevertheless, regular consumers are more convinced than sporadic consumers with respect to enlarging the market period.

Size is an important aspect of PDO Calanda peaches quality. Most consumers always eat the largest peaches by themselves, but many consumers will never adopt this habit. In some occasions they can share with other person and less often they finish it later. It suggests that consumers do not like to share the same fruit with other person and they rather prefer to eat it at once.

Although a great percentage of consumers are not able to eat the largest PDO Calanda peach, there is a strong preference for big size peaches. More than half of consumers state that they like it while only more than 10% dislike big peaches. Thus, a good market share for largest PDO Calanda peaches would be around 50%, around 40% for medium size and 10% for small size peaches.

Chapter 4: Importance of PDO Calanda peaches attributes at purchase occasions

4.1 Introduction

Consumer behaviour studies have mostly tried to find out which attributes are interesting to determine consumers' perceived quality. They also try to determine how important they are on consumers' preferences and on consumers' purchase decisions. Understanding consumers' needs and desires and their variations among consumers can provide a great advantage for business and more effective policies for institutions.

The purpose of this chapter is to assess the relative importance of the 10 selected attributes of PDO Calanda peaches (Table 4.1) - on Zaragoza consumers' purchase decision. The relationship between attribute importance and consumers characteristics, such as, socio-demographic data and their attitudes towards PDO Calanda peaches has also been studied. Finally, different market segments, according to the importance degree that consumers attach to different attributes, have been estimated.

Table 4.1 PDO Calanda peaches selected attributes

Code	Attribute	Code	Attribute
1	Taste	6	Peach size
2	Colour	7	Packaging
3	Price	8	Ripeness
4	Produced in bags	9	Skin fuzziness
5	Smell	10	Texture

This chapter first justifies why best – worst scaling is employed (section 2). The following section, section 3, describes the experimental design. The relative importance attributes are estimated by Best-Worst average scores and the relationships between consumers' characteristics and attribute importance are explored in section 4.1. The theoretical background of using Multinomial Logit (MNL) model to estimate the relative importance of attributes is described at the beginning of section 4.2. This section is also focused in the evaluation of the best, worst and best-worst choice alternatives. In the following section, taken into consideration the relative importance of each attribute, the total number of market segments and their representativeness are calculated. Finally, a section is dedicated to further remarks regarding the main findings of these analyses.

4.2 Best - Worst Scaling (BWS)

There are many quantitative methods to study consumers' preferences regarding sets of attributes using surveys. Rating, constant sum task, ranking and paired comparison methods are commonly used for this propose but more recently the Best-Worst Scaling has been proposed.

Respondents' fatigue to answer the survey is considered. Answers from tired consumers can be of low quality because they might not reply consistently about their real preferences. Inconsistencies skew results and they reduce the estimated model's predictive power of consumers' behaviour. Hence methods such as rating, with an easy answering task, became popular in social sciences because it avoids the problem of people having fatigue.

Rating methods employ scales and the Likert scale is the most usual. Consumers need to tick different weights to each attribute, according with their preferences when they use the Likert scale. There are many weights levels, but normally they vary from 5 to 9. In marketing, for example, those weights can be the attributes' importance degree when consumers purchase a product. In the case of 5 weights levels, each level can be labelled as very important, important, moderately important, of little importance and non important.

The advantages of rating tasks are its simplicity to be understood by people and the fact that they do not get tired quickly. As rating tasks are easy, it allows studying a large set of attributes. However, people value each attribute independently and there is not a trade-off among attributes. Cohen (2003) finds that rating is a low discriminative method to value attribute importance. Thus, he does not recommend this method when the study claims a good discrimination among attributes.

Another limitation of ratings is the scale bias. It is common to have cases when people say that every attributes is very (or not) important and they give them the same weights. In this case, consumers are not ordering their preferences and, therefore, it is not possible to draw reliable conclusions.

According to Cohen (2009), respondents may perceive distances but each person could have a different perception about distance. Hence treating categories as equal interval scales may generate different conclusions than if they are treated in an ordinal scale.

The uses of scale-free approaches are the solution for scale bias problem. Constant sums or allocation tasks, is a scale-free method and it implies to undertake trade-offs. Subjects have to spread an amount of points, for example 100 points, among the different attributes according to their importance. Constant sum tasks can become very difficult when there are many attributes to be compared (Cohen, 2003) and subjects may have difficulties distributing values that sum to a particular amount (Sawthooth, 2007).

Ranking is another employed method. Subjects are requested to order a set of attributes according to their importance. It is also a scale free method and it requires respondents to trade-off among attributes. In comparison to the constant sum method, the raking method is indicated to study large sets of attributes. However, ranking tasks become difficult when there are more than 7 attributes to be ordered at once. The output is other limitation of this method because it gives only the attribute order, but it does not provide the importance degree of each attribute (Sawtooth, 2007; Cohen, 2003).

The paired comparisons method has been used traditionally in social science. Thurstone in the 1920s demonstrated that this method yields an interval scale ordering of items. It is a scale free and there is a trade-off among attributes because subjects have to undertake repeated choices of the best (or the most important) alternative (attribute) in choice sets with two alternatives. The number of choice sets depends on the total number of attributes and their relation is exponential. Thus, the task can be exhausting when the number of attributes is very large. To overcome such limitation, Finn and Louviere (1992) proposed the Best-Worst Scaling (BWS).

The Best-Worst Scaling (BWS) approach, also known as maximum difference scaling (MaxDiff), is an extension of the Thurstone`s Random Utility Theory (RUT). This approach has a finite set of potentially choice alternatives T (in this case represent all attributes), also called master set, and there are sub-sets Xs (they are the choice sets), $X \subseteq T$, of available alternatives. Each choice set has $J \geq 3$ available alternatives and subjects are invited to state the best (or the most important) and the worst (or the least important) alternatives (attribute).

BWS provides more information than paired comparisons and it requires less input from respondents. For example, on sensory studies if there are 7 attributes to be valued, participants would need to undertake 42 tastes and provide 21 responses in the paired approach. In the same conditions, the BWS approach with 7 choice sets of 3 alternatives would require 21 tasting and 14 responses (Jaeger *et al.*, 2008). Although the BWS task is a little bit more difficult than the paired comparison approach, subjects prefer to answer less choice sets, which increase the BWS relevance. Cohen (2009) explains that the paired comparison approach is a task too repetitive for respondents when the number of choice sets is large.

BWS is an appropriate approach for studies which demand trade-offs among attributes. This discrimination among attributes is obtained as a consequence of decision processes. During the decision process, subject *q* identifies and calculates utilities differences of every pair of available alternatives $[J(J-1)]$[6] in a choice set and he selects the pair that maximizes the utility (or importance) difference. Empirically, Cohen (2003) contrasts the discriminative power between BWS, paired comparison and rating tasks. He finds that the BWS has the greatest discriminative power (with t-test of 7.7) and it is followed by the pair comparison discrimination (with t-test of 6.3) and by the rating (with t-test of 3.3). This superior discrimination power of BWS represents another reason that justifies its use over other methods.

BWS has been broadly used in many fields. Gardener and Ashworth (2007) study the attitudes of Australians toward electricity demand management features; Flynn *et al.* (2008b) analyse aspects of life quality related to old people; Auger *et al.* (2007) uses BWS to examine consumers' attitudes toward ethical products in six countries; Buckley *et al.* (2007) examine characteristics' importance for foreign direct investments locations; Burke *et al.* (2010) look for different museums visitors segments in Australia; in health economics Vick and Scott (1998) measure the relative patients' values of various attributes related to general practical consultation and Flynn *et al.* (2008a) study patients' preferences between quality of care and waiting time; and many papers use this method to study the attributes importance for wine consumption (Cohen, 2009; Cohen *et al.*, 2009; Casini *et al.*, 2009; Remaund and Lockshin, 2009; Mueller and Rungie, 2009; and Goodman, 2009).

[6] There are K(K-1) combination of pairs of alternatives in a choice set with K attributes. Note that if subject *q* considers the alternative (attribute) *b* as the best (most important) alternative and *w* as the worst (the least important) alternative, BWS takes it in account that D_{bw} is different of D_{wb}. That is, the BWS approach does not only consider the utility difference between alternatives, but it also takes into account which are the best and the worst alternatives.

4.3 BWS experimental design

According to Casini *et al.* (2009), the experimental design of Best – Worst experiments of attributes can be undertaken by Latin Square Designs, although Full Factorial Designs, Fractional Factorial Designs and Balanced Incomplete Block Designs are more common in this kind of choice experiment. If in a full factorial design, the adopted experimental design has 2^k combinations or choice sets, the total number of combination has base 2 because this number represents the presence and the absence of the attribute in the choice set. Letter k represents the number of attributes and the Full Factorial has 1,024 (2^{10}) choice sets, which would be too large for a survey.

To avoid a large number of choice sets from a Full Factorial Design, it is usual to employ a Fractional Factorial Design. In a Fractional Factorial Design, the numbers of choice sets is reduced to 2^{k-m} (in this case to 2^{10-m}). The minimum number of choice sets depends on the estimated model, which is the total number of estimated parameters plus one (degree of freedom). The numbers of estimated parameters is a function of the number of considered attributes and the different kinds of effects, either no main or interaction effects. When the number of parameters is very lage, the choice sets from a Fractional Factorial Design can be divided in many versions, originating a Balanced Incomplete Block Design. In this case, each respondent fills one version, or a portion, of a Fractional Factorial Design.

The 2^k Fractional Factorial Design, with or without blocking, is often used in BWS studies. In this work the experimental design was generated by the software "Sawtooth MaxDiff Designer". This software provides simulations with different combinations of attributes to get the best experimental design properties.

According to Sawtooth (2006), this program by default and in order considers the following properties: one-way frequency (how many times each attribute appears across the entire design), two-way frequencies (how many times each pair of items appear within the same set across the entire design), positional frequencies (it reports how many times each item appears in the first, second,…, fifth position) and connectivity (all items are linked directly).

The experimental design is drawn by the Sawtooth Software when different characteristics are introduced in the program, such as the number of versions, number of simulations, designed seed, number of attributes, number of choice sets per version and the choice set size (number of alternatives or attributes in each choice set, which for no adaptive designs every choice set has the same number of alternatives).

There is a positional effect of attributes on respondents' choice decisions. However, experimental designs with more than one version mitigate this effect. But when more than one version is used, the number of observations of each version should be the same; otherwise the experimental design loses orthogonally. One aim of this study is to estimate the attributes importance on purchase decision for different market segments. As it was expected that consumer groups had different sizes, eventually resulting in different layouts of each experimental design version, in this empirical work only one experimental version was adopted.

By default, the MaxDiff Designer repeats its algorithm 1,000 times and it reaches the best design. As the program runs very fast, the final design resulted after 1,000,000 interactions, which is the maximum number of simulations available in the program. The designed seed can be generated randomly by the program, but a chosen seed (70) was used to allow repetitions of the experimental design.

There are 10 PDO Calanda peaches' attributes to be assessed by consumers. The next step is to determine the choice set size and the number of choice sets that each consumer would answer. Choice experiments, with best-worst statements, have at least 3 alternatives or options in each choice set. When the number of alternatives of a choice set increases it provides more information. For example, considering that there were 4 attributes (A, B, C and D), which result in 4! = 24 combinations of possible preferences. Suppose that a consumer had the following preference order: A>B>C>D (which is one particular combination from these 24), that is, A would be the most preferable good (or attribute), B would be preferable to C and D, and C would be preferable to D (which is the least preferable). If the choice set had 3 alternatives and the consumer would state the best and the worst alternatives from this choice set, getting a complete ranking, it is possible to say that, considering the attribute D, the 24 initial combinations of possible preferences is reduced only to 4 possible combinations[7], but if the choice set had 4 alternatives and consumers would state the best and the worst alternative, the number is

[7] For example, if the choice set had the full ranked attributes A, B and C, it would be possible to conclude that the possible combinations of consumers preferences would be A>B>C>D or A>B>D>C or A>D>B>C or D>A>B>C (4 possibilities) because one can not "guess" the rank order of attribute D in this choice set.

reduced[8] to 2. It means that, in best – worst tasks, choice sets with 4 alternatives provides the double of information (ranking) than choice sets with 3 alternatives. This amount of extra information increases to 3.3 times more information with a choice set of 5 alternatives than one with 3 alternatives.

There are two limitations for large choice sets (more than 6 alternatives in each choice set) for their implementation in attributes BW choice tasks. One is own respondents' cognitive ability to choose the right attributes in the choice set according to his real preference, e.g., the consumer response quality decreases when the number of alternatives increases. Orme (2005) recommends 5 alternatives per choice set because at this point, the marginal benefit of extra information from increasing choice sets is equal to the marginal cost of responses quality. Chrazn and Patterson (2006) consider the time employed giving the answers by respondents as a proxy of cognitive effort, and they advise using 4 or 5 items per choice set.

The second limitation occurs when there are too many alternatives (attributes) in relation the total number of attributes to be studied. According to Orme (2005) the number of alternatives per choice set must be less or equal than half of total attributes, otherwise estimations of attributes of middle importance on consumers preferences have low precision. Thus, looking for the best design to study the 10 PDO Calanda peaches attributes, each choice set has 5 alternatives (attributes).

The number of choice sets to be presented to respondents is another parameter in the experimental design to be considered. The number of choice sets (N_{csets}) is a function of the total number of assessed attributes (10), number of alternatives in each choice set (5) and the number of times that each attribute is presented across choice sets to each respondent (R), $N_{csets} = 10R/5$. Consequently, it is still necessary to determine "R".

Through Monte Carlo simulations, Ome (2005) has calculated that increasing the number of times that one particular attribute is presented to a respondent, the estimations of the attribute importance is more accurate, but he also affirms that presenting each attribute 3 or more times allows getting estimations with reasonable precisions at individual level. There were not found empirical works dealing with this issue, and considering that the survey would have another choice task (best-worst

[8] In this case one would see that attribute A is the most preferable and D the least (partially ranked), so the possible combinations of rank order would be: A>B>C>D or A>C>B>D (2 possibilities).

choice experiment with a multi-attribute design) and thinking on respondents fatigue, it was decided to repeat each attribute 4 times across choice sets (R = 4), resulting in 8 choice sets with 5 alternatives each one. The next step was the distribution of the attributes in choice sets.

The Sawtooth Software is employed. The result of one million interactions is the final outcome of a design with no lack of connectivity and is a one-way frequency balanced (every attribute has the same chance to be chosen) but not two-way frequency balanced (when one-way and two-way frequencies are balanced and the experimental design is orthogonal) and with a positional frequency mean of 0.8 and standard deviation of 0.4 (a standard deviation of 0 reflects a perfect balance). A balanced design is a desired property, but Hessian Bayesian (HB) and Latent Class (LC) methods do not require an exact balance. Imperfect balance does not avoid unbiased estimations with HB and LC methods (Sawtooth, 2006). The attributes distribution across choice sets is displayed in the Table 4.2.

Table 4.2 Distribution of 10 attributes across the choice sets

Choice set	Attribute position				
	1^{st}	2^{nd}	3^{rd}	4^{th}	5^{th}
1	2	6	9	4	1
2	6	3	10	5	8
3	8	4	1	10	7
4	5	9	3	8	4
5	9	8	2	6	10
6	1	7	6	3	2
7	7	10	5	2	9
8	3	1	4	7	5

For example, choice set 1 presented the PDO Calanda peaches attributes: colour (attribute 2 – see also Table 4.2), peach size, skin fuzziness, produced in bags and taste, and these attributes are ordered to consumers from left to right, respectively. First, consumers analyse every available alternative and then they decide which of the PDO

Calanda peaches' attribute is the most and as the least important attributes when they purchase them.

4.4.1 Best – Worst score analysis

There are two ways to assess the attributes impacts by the Best-Worst Scaling approach, one is with Best-Worst scores and the other is with Multinomial Logit (MNL) models. This section deals with Best-Worst score results.

In total, 316 consumers of PDO Calanda peaches participated in a survey in 2008 (their profiles are described in chapter 3). Table 4.3 shows, the number of times that all consumers state for each attribute as the most (B) and the least (W) important PDO Calanda peaches' characteristic at purchase locations. For example, taste is selected more often (855 times) as the most important and less often (only 15 times) as least important characteristic of PDO Calanda peaches; on the other hand, packaging is more often (740 times) stated as the least important and less often (just 36 times) as the most important characteristic.

Table 4.3 PDO Calanda peaches attributes importance on aggregated level

Rank	Attributes	Total		Ratio	Relative
		Most (B)	Least (W)	(B/W)	Importance
1st	Taste	855	15	57.00	100.00
2nd	Ripeness	553	48	11.52	20.21
3rd	Smell	315	78	4.04	7.09
4th	Colour	170	97	1.75	3.07
5th	Price	239	169	1.41	2.48
6th	Texture	154	126	1.22	2.14
7th	Produced in bags	74	292	0.25	0.44
8th	Peach size	92	413	0.22	0.39
9th	Skin fuzziness	40	550	0.07	0.13
10th	Packaging	36	740	0.05	0.09
Number of consumers = 316					

Ranking all attributes independently, according the total number of times that they are stated as the most and the least important attributes, it provides a different rank order, especially for middle ranked attributes. In the case of the most important attributes choices: price, colour, texture, peach size, and produced in bags take the 4^{th}, 5^{th}, 6^{th}, 7^{th} and 8^{th} position, respectively; while for the least important attributes choices, this rank order is 6^{th} (it changes 2 positions), 4^{th} (1 position), 5^{th} (1 position), 8^{th} (1 position), 7^{th} (1 position), respectively.

It is also possible to estimate the attributes relative importance and ranking them, considering jointly the total number of times that they are indicated as the most and the least important attribute, by the ratio between their scores ratios (B/W). According to the attributes' ratios, taste is the most important attribute because it has the highest ratio (855/15 = 57). The ratio of 57 means that this attribute is stated as the most important attribute 57 times more often than the least important.

The relative importance for all attributes is estimated to make easier comparisons about the attribute importance. The relative importance is based on the most important attribute. So, taste B/W ratio gets a value of 100 and all other relatives values are calculated proportionally. Hence, the relative importance of ripeness is 20.21 because its B/W ratio weights around 20% of the taste's B/W ratio. The least important attribute, packing, weights only 0.09% of taste importance.

Every attribute is ranked by the B/W ratio (Table 4.3). If this rank order is compared with the most (B) and the least (W) important attribute rank order, there are some differences. In relation to the ranking order from the most important attributes (B), price, colour, peach size and produced in bags change one position in the BW rank order and texture and price change one position, each one, in relation to the least important classification.

Table 4.3 results are shown aggregated, but they were transformed in Table 4.4. For example, Best-Worst average score of taste, is calculated from the difference between the total number of times that it is chosen as the most important and the total number of times that it is chosen as the least important (855 – 15 = 840). Then, this difference is divided by the number of consumers in the survey (840/316), resulting in a BW average score of 2.66. Note that, as each attribute appears 4 times across choice sets, its range values vary from -4 to +4. A positive value means that the attribute is chosen more often as most important than least important (B – W > 0) and if the value is +4 implies that it is always the most important option for all the choice sets.

An analysis is carried out, at individual level, from individual attributes Best-Worst scores (Table 4.4). The attribute *k* BW score of subject *q* is calculated just taking the difference between the numbers of times that subject *q* chooses attribute *k,* across choice sets, as the most important and the least important attribute. Those individual BW scores, allowed the estimation of lower and upper BW score values of each attribute, at 95% of probability. The sample t-test is used, which is available in the SPSS software.

Table 4.4 PDO Calanda peaches attributes importance at individual level

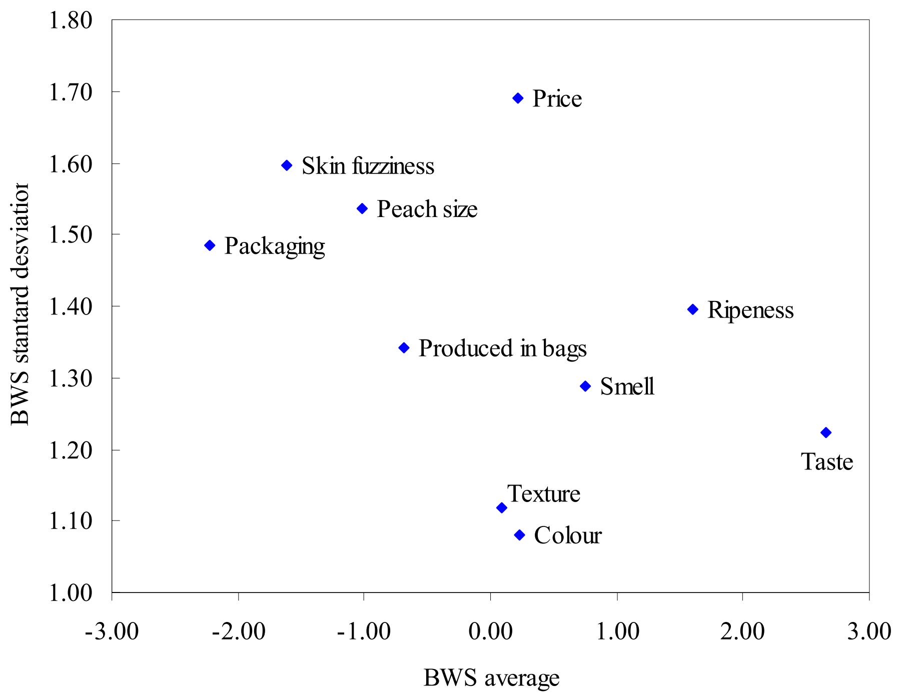
		B W Score	Confidence Interval[1]		Homogeneous subsets[1]						
Rank	Attributes	Average	Lower	Upper	S1	S2	S3	S4	S5	S6	S7
1st	Taste	2.66	2.52	2.79	X	-	-	-	-	-	-
2nd	Ripeness	1.60	1.44	1.75	-	X		-	-	-	-
3rd	Smell	0.75	0.61	0.89	-	-	X	-	-	-	-
4th	Colour	0.23	0.11	0.35	-	-	-	X	-	-	-
5th	Price	0.22	0.03	0.41	-	-	-	X	-	-	-
6th	Texture	0.09	-0.04	0.21	-	-	-	X	-	-	-
7th	Produced in bags	-0.69	-0.84	-0.54	-	-	-	-	X	-	-
8th	Peach size	-1.02	-1.19	-0.85	-	-	-	-	X	-	-
9th	Skin fuzziness	-1.61	-1.79	-1.44	-	-	-	-	-	X	-
10th	Packaging	-2.23	-2.39	-2.06	-	-	-	-	-	-	X
Number of consumers =316											

Note: (1) Confidence level at 95%

For example, taste BW average score values vary between 2.52 and 2.79, at 95% of confidence. It the case of texture, its BW average score varies between -0.04 and 0.21, which indicates that it may be mentioned more often as most important than least important or vice versa. The possibility that the attributes BW average scores could take the same value was also analysed. Hence estimations of homogeneous BW scores subsets were carried out by Anova (Tukey HSD) tests. Results demonstrate that there are not statistical differences among colour, price and texture BW average scores, i.e., consumers consider PDO Calanda peaches prices as important as its colour or texture on their purchase decision. Producing PDO Calanda peaches in bags is also as important as peaches sizes.

Mueller and Rungie (2009) mention that, for marketing purposes, companies need to direct their attention to the most important product attributes and they should also take into account the consumers' preferences heterogeneity regarding these products' attributes importance. Graphic 4.1 shows the relation between BW score average and BW score standard deviation (SD) of every PDO Calanda peaches attribute. Consumers' preferences are more homogeneous with respect to colour because it has the lowest SD and it is followed by texture and taste. PDO Calanda peaches taste is an attribute which deserves an especial attention for business men and government because it is very important and it has a low heterogeneity in their preferences. Any positive decision from these stakeholders towards this characteristic could have a great impact on consumers' buying decisions and finally on its consumption. Because their heterogeneity, there are more market segments with respect to price, skin fuzziness and peach size. Those attributes have an intermediate relative importance and the greatest SD.

Graphic 4.1 Relationship between PDO Calanda peaches attribute importance and heterogeneity



Correlation among attributes tries to find their relationships. Thus, the Pearson correlation matrix from BW scores of every PDO Calanda peaches' attribute is calculated and the results are shown in Table 4.5. Consumers have considered peach taste as the most important attribute but they also assess ripeness as very important and they give less importance to peach size, price, packing and produced in bags. It means that those consumers who wish a tasty peach will not matter if peach is expensive and, on the other hand, those who consider price an important characteristic give less importance to taste, they are more willing to sacrifice taste for money.

Table 4.5 Pearson correlation matrix of PDO Calanda peaches attributes importance

Attributes	Taste	Colour	Price	Produced in bags	Smell	Peach size	Packaging	Ripeness	Skin fuzziness
Colour	-0.16^{***}	1.00	-	-	-	-	-	-	-
Price	-0.27^{***}	0.00^{ns}	1.00	-	-	-	-	-	-
Produced in bags	-0.17^{***}	-0.21^{***}	-0.10^{*}	1.00	-	-	-	-	-
Smell	0.05^{ns}	0.06^{ns}	-0.28^{***}	-0.09^{ns}	1.00	-	-	-	-
Peach size	-0.30^{***}	0.00^{ns}	-0.02^{ns}	-0.07^{ns}	-0.14^{***}	1.00	-	-	-
Packaging	-0.25^{***}	-0.18^{***}	-0.20^{***}	0.03^{ns}	-0.10^{*}	0.07^{ns}	1.00	-	-
Ripeness	0.21^{***}	-0.13^{**}	-0.19^{***}	-0.03^{ns}	-0.24^{***}	-0.16^{***}	-0.18^{***}	1.00	-
Skin fuzziness	0.02^{ns}	-0.05^{ns}	-0.10^{*}	-0.38^{***}	-0.02^{ns}	-0.31^{***}	-0.12^{**}	-0.09^{ns}	1.00
Texture	0.07^{ns}	-0.12^{**}	0.00^{ns}	0.09^{ns}	-0.06^{ns}	-0.22^{***}	-0.21^{***}	-0.14^{**}	-0.07^{ns}

Note: *** Correlation is significant at the 0.01 level (2-tailed); ** at the 0.05 level (2-tailed); * at the 0.10 level (2-tailed); and ^{ns} correlation is not significant (2-tailed).

The importance of taste is not correlated with smell, skin fuzziness and texture importance. This independence confirms that there are markets segments that value attributes differently. For example, if there are two markets segments, one positively correlated and other negatively correlated, the global correlation may be null.

As many statistical significant correlations among attributes BW scores are detected, a Principal Factor Analysis, with Varimax rotation and Kaiser Normalization, to reduce the number of attributes and classify them in groups has been carried out. It results in five factors, which explain 70.2% of variance and, in each factor, there are two attributes that have high explanation power (Table 4.6).

Factor 1 explains 17.9% of the variance and is named as organoleptic sensitive factor because its high correlation with ripeness (0.87) and taste (0.64), i.e., consumers give great importance to both attributes (they are positively correlated with this factor). The second factor is characterized by the high positive correlation for produced in bags and high negative for skin fuzziness. It means that this factor embraces those consumers who pay great attention to bag production but are sensitive to fuzziness. As peaches produced in bags have less pesticide than others, this factor will be called as safer factor. Note that this factor is the only one where taste has negative correlation (low importance).

Table 4.6 Choice attribute factor loading for principal component analysis

Attributes	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Ripeness	**0.87**	0.07	-0.14	-0.14	-0.04
Taste	**0.64**	-0.15	0.31	0.29	0.05
Skin fuzziness	-0.04	**-0.87**	0.18	-0.01	-0.13
Produced in bags	-0.06	**0.73**	0.24	-0.01	-0.29
Texture	-0.12	0.21	**0.77**	-0.03	0.02
Peach size	-0.19	0.32	**-0.65**	-0.11	0.08
Smell	-0.23	-0.04	0.09	**0.79**	0.24
Price	-0.30	-0.05	0.05	**-0.77**	0.25
Colour	-0.18	-0.07	-0.25	0.11	**0.72**
Packaging	-0.30	-0.01	-0.40	0.15	**-0.72**
Variance explained	17.9%	15.0%	13.3%	12.7%	11.3%

Note: Extraction method: Principal component analysis. Rotation method: Varimax with Kaiser Normalization. Rotation converged in 7 interactions. In bold, it is shown the highest correlations within factors.

The third factor explains 13.3%s of the total variance and the two highest correlated attributes are texture and peach size, with positive and negative correlations, respectively. In this factor, texture in very important for consumers while size is not, then it is called touch factor. In factor 4 smell and price have the highest correlation and they are positively and negatively correlated, respectively. It means that people less sensitive to money will me more sensitive to DOP Calanda peaches' smell. This factor is known as smelling organoleptic sensitive. In contrast with factor 1, which is also another organoleptic factor, factor 4 has positive correlations with colour and packing and negative with ripeness.

In the last factor, the highest correlated attributes are colour and packing and their sign are, respectively, positive and negative. In means that in this factor, which explains 11.3% of the total variance, consumers give high importance to colour and low importance to packing. Its name is colour sensitive factor.

The next step is to analyse if there are different BW average scores according to consumers' socio-demographics characteristics and their attitudes towards PDO Calanda peaches. The BW scores were compared according to the U of Mann-Whitney test. Attributes that present significant differences[9] among consumers on socio-demographic features and on attitudinal profile are listed in Table 4.7 and Table 4.8, respectively.

There are not significant differences for the relative importance of PDO Calanda peaches attributes such as gender, buyer activity and presence of children and teenagers at home. Some attributes, such as colour, price, smell and texture have similar relative importance among consumers with different socio-demographic characteristics.

In relation to age, oldest consumers (≥ 65 years old) give less importance to taste (with BW average score of 1.98) than consumers who are between 25 and 50 years old (from 25 to 35 years old give taste a BW average score of 2.81 and between 35 to 50 years a 2.97 score). The oldest consumers give more importance to peaches produced in bags (-0.06) than those who are between 25 and 50 years old and they also give more importance to packing than everybody else. Consumers with age from 50 to 65 years old value taste as less important (2.46) than those between 35 to 50 years old (2.97) and peach size as less important (-1.49) than the oldest consumers (-0.53) and those between 25 to 35 years (-0.81). They assess more importance to peaches produced in bags than those between 25 to 50 years old.

Consumers with elementary education give less importance to taste because they give this attribute a BW average score of 2.20, while 2.77 for those consumers with high school and 2.92 for those with college education. In relation to consumers with college education, consumers with elementary education give more importance to packing and less importance to ripeness.

Consumers with different household income value differentially the relative importance of peaches tastes, packing and peaches ripeness. Consumers with the lowest income (less than 900 Euros per month) give less importance to taste than those with household income greater than 3,000 Euros per month. This group of consumers (with the lowest household income) also considers ripeness less important than the rest of consumers.

[9] The difference is considered significant just when the hypothesis of null was rejected at 1% of statistical confidence.

Table 4.7 PDO Calanda peaches attributes relative importance[1] according to consumers' socio-demographic characteristics

Socio - economic variables	Taste	Produced in bags	Peach size	Packaging	Ripeness	Skin fuzziness
Age (years old)						
< 25 years x ≥ 65 years	-	-	-	-2.88 / -1.47	-	-
25 to 35 years x 50 to 65 years	-	-1.10 / -0.31	-0.81 / -1.49	-	-	-
25 to 35 years x ≥ 65 years	2.81 / 1.98	-1.10 / -0.06	-	-2.34 / -1.47	-	-
35 to 50 years x 50 to 65 years	2.97 / 2.46	-0.99 / -0.31	-	-	-	-
35 to 50 years x ≥ 65 years	2.97 / 1.98	-0.99 / -0.06	-	-2.35 / -1.47	-	-
50 to 65 years x ≥ 65 years	-	-	-1.49 / -0.53	-2.29 / -1.47	-	-1.24 / -2.11
Education level						
elementary x high school	2.20 / 2.77	-	-	-	-	-
elementary x college	2.20 / 2.92	-	-	-1.87 / -2.57	1.22 / 1.86	-
Household income (€/month)						
< 900 x 900 to 1,500	-	-	-	-	0.74 / 1.58	-
< 900 x 1,501 to 2,100	-	-	-	-1.30 / -2.24	0.74 / 1.58	-
< 900 x 2,101 to 3,000	-	-	-	-1.30 / -2.47	0.74 / 1.59	-
< 900 x 3,001 to 4,000	2.17 / 3.00	-	-	-	0.74 / 2.00	-
< 900 x >4,000	2.17 / 3.08	-	-	-1.30 / -3.25	0.74 / 2.00	-
900 to 1,500 x >4,000	-	-	-	-1.93 / -3.25	-	-
1,501 to 2,100 x > 4,000	-	-	-	-2.24 / -3.25	-	-
2,101 to 3,000 x > 4,000	-	-	-	-2.47 / -3.25	-	-

[1] The relative importance is measured by BW average scores. The U of Mann-Whitney test to calculate the statistical differences among BW scores is employed. Only those attributes with BW average scores which have statistical significant differences, at 1% of confidence, among socio – demographic characteristics are reported.

Consumers with the greatest household income assess packing as less important than consumers with family income below 4,000 Euros per month. Those consumers with household income below 900 Euros per month give more importance to packing than those with household income from 1,501 to 3,000 Euros per month.

Table 4.8 PDO Calanda peaches attribute relative importance[1] according to consumers' attitudes toward PDO Calanda peaches

Consumers' attitudes	Price	Produced in bags	Skin fuzziness
Consumption frequency			
Regular x Sporadic	-	-0.51 / -1.02	-
Loyalty degree			
Low x High	-0.18 / 0.45	-	-1.21 / -1.80

[1] The relative importance is measured by BW average scores. The U of Mann-Whitney test to calculate the statistical differences among BW scores is employed. Those attributes with BW average scores which have statistically significant differences, at 1% of confidence, among consumers' attitudes toward PDO Calanda peaches is reported.

There are not statistical significant differences of attribute relative importance for consumers who purchase PDO Calanda peaches in different places (markets, supermarkets, etc.), who store them in diverse locations and for different periods of time and eating behaviour of largest PDO Calanda peaches. Statistical differences on attribute importance are found only between those consumers with different PDO Calanda peaches' consumption frequency and between low and high loyalty degree.

Consumers with different PDO Calanda peaches' consumption frequency only value produced in bags differently. Producing PDO Calanda peaches in bags is more important for regular consumers (BW average score of -0.51) than sporadic consumers (BW average score of -1.02) (Table 4.8). This difference can be explained by a better knowledge about the production system benefits, less pesticide use and higher social impacts, from regular consumers.

Consumers with low and high loyalty degree value the importance of price and peach skin fuzziness in a different way. Consumers with high loyalty degree, i.e., those who would not buy a stone fruit if they could not find PDO Calanda peaches available in the market, give more importance to price and less importance to skin fuzziness on their PDO Calanda peaches' purchase decisions than consumers with low loyalty degree.

4.4.2 Best – Worst Multinomial Logit analysis

Although Best-Worst Scaling (BWS) is developed by Louviere and Woodworth as a multiple choice extension of the Thurstone's method of paired comparisons at the beginning of 1990's (Finn and Louviere, 1992), the underlying theoretical properties are formally presented by Marley and Louviere (2005). They proved that best – worst probabilities are consistent with the Random Utility Model (Luce, 1959) and they are equivalent to Multinomial Logit models (McFadden, 1974). This method assumes that consumers compare all utilities differences between all pair of alternatives and that the pair of alternative which is selected is that one who maximizes the utility difference between alternatives. It is why this method is also known as MaxDiff method

Equation 4.1 captures the probability of subjects *q* choosing the pair of alternatives *bw* (alternative *b* as the best or the most important attribute and alternative *w* as the worst or the least important attribute) between all *ij* pairs of alternatives, $ij \neq bw$, in the subset *C* (choice set).

$$P(bw/C) = P\left[(\delta_{bw} + \varepsilon_{bw}) > \text{all other } (\delta_{\text{ij}} + \varepsilon_{ij})\,\text{pairs}\right] \qquad 4.1$$

Here, δ_{bw} is the utility or importance difference between the most and the least important attributes (note that, this model does not consider that the utility difference between the most and the least important attributes is the same than the utility difference between the least and the most important attributes) and it is observed, while the term ε_{bw} is the error term or the stochastic term and it is not observed by researcher.

Another assumption is that ε_{bw} is a random variable distributed independently and identically as an extreme value type 1 (equivalently, as a Gumbel, Weibull or double exponential). It is known that these assumptions lead to the multinomial logit (MNL) model, which is the basic model used in this work. Thus, the choice probability can be expressed as in equation 4.2. *Ic* is the set of all possible pair of combination from avaiable alternatives of subset C.

$$P(bw/C) = \exp(\delta_{bw}) \Big/ \sum\nolimits_{ij} \exp(\delta_{ij}), \text{ for all } i, j \neq b, w \in I_C \qquad 4.2$$

Marley and Louviere (2005) demonstrate that the expression δ_{bw} can be divided in two scale values, say s_b and s_w, or $s_b - s_w$. Therefore, equation 4.2 can be rewritten as equation 4.3. Thus, the scale values of interest are s_b and s_w, which reflect the location of each attribute on the underlying scale.

$$P(bw/C) = \exp(s_b - s_w) / \sum_{ij} \exp(s_i - s_j), \text{ for all } i, j \neq b, w \in I_C \qquad 4.3$$

Estimations of attribute importance are carried out by one or another way depending on the kind of experimental design. When the experimental design does not allow one to get all implied combinations of bet–worst and worst–best pairs across subsets (these combinations are obtained by using 2^k Orthogonal Main Effect Design + its foldover, or by Balanced Incomplete Block Design (BIBD) + its complement), then one can approximate the desired scale value $(s_b - s_w)$ by taking differences in the marginal best and worst counts for each attribute. That is, the simple score $\delta(b, w) = \text{total best } b - \text{total worst } w$, for each individual or subset of individuals who exhibit the same underlying ordering of the attributes (Auger *et al.*, 2007).

Suggestions from Sawtooth (2007) for best-worst estimations are followed. Attributes are dummy-coded for a matrix with k-1 parameters in which the last attribute (texture) is omitted and constrained to have zero weight. For most important alternatives (attributes) choices (when respondent is maximizing utility) the dummy takes value 1 and for least important alternatives choices (when respondent is minimizing utility) the dummy takes value -1.

4.4.2.1 Defining the best fitted model

Discrete choice model are normaly compared using the final likelihood as well as the adjusted R^2, but they have to have same number of parameters and observations. In the next section, it is compared models with different number of observations (some consider only one choice per choice set and others two choices) and in one model has different number of parameters.

Thus, Consistent Akaike Information Criteria (CAIC) was employed to determine which approach has better statistical properties. This criteria is also used in other works, such as, Zhu and Timmermans (2009), Creel and Farell (2008) and Harris *et al.* (2006) who used this criteria with the same objective: compare alternatives choice models. Equation 4.4 shows who CAIC is calculated and Npar is the number os parameters in the tested model and Ncset is the number os choices or number of observations.

$$CAIC_m = -2 Log\ Likelihood + \mathrm{N}_{\mathrm{par}} \times (\ln N_{cset} + 1) \qquad 4.4$$

4.4.2.2 Best, Worst and Best-Worst choices estimations with and without scale factors

Four Multinomial Logit (MNL) models have been calculated in order to compare the preference consistency among best, worst and best-worst alternative choices. Model 1 is estimated from choice data with the most important alternatives within choice sets, i.e., consumers state those alternatives which maximize their utility (importance) on PDO Calanda peaches purchase. Model 2 is calculated from choice information with the least important alternatives within choice sets and, in this case, consumers state those alternatives which minimize their utility (importance) on PDO Calanda peaches buying decisions. Both models are estimated by the free software package Biogeme version 1.7 (Barbiere, 2008).

Attributes' rank order from model 1 and 2 are very different (Table 4.9). Only taste and ripeness order match up, price changes three positions between these models and the rest of attributes shift one position. Model 1 has better fit than model 2 because its final log likelihood has smaller negative value, a higher adjusted R^2 and, specially, smaller CAIC.

Model 1 explains better the data variance and it provides six statistical significant parameters while model 2 provides eight statistical significant parameters. In model 1, the parameter accuracy, measured by t-test, decreases from the most important attribute to the least important attribute and the opposed happens with model 2. The explanation to this accuracy differences is the unbalance information between these two models. Model 1 has more information regarding the most important attributes whereas model 2 has more data about least important attributes.

Table 4.9 Relative importance of PDO Calanda peaches attributes estimated by Multinomial Logit (MNL) models

		Model 1 Best alternatives		Model 2 Worst alternatives	
Rank	Variables	Parameter	t - test	Parameter	t - test
1st	Taste	2.31^{***}	21.79	1.92^{***}	6.95
2nd	Ripeness	1.53^{***}	15.73	1.05^{***}	6.15
3rd	Price	0.85^{***}	7.56	-0.26^{**}	-2.17
4th	Smell	0.77^{***}	7.61	0.48^{***}	3.3
5th	Colour	0.11^{ns}	0.98	0.04^{ns}	0.25
7th	Peach size	-0.23^{ns}	-1.65	-1.17^{***}	-11.17
6th	Produced in bags	-0.24^{ns}	-1.62	-0.97^{***}	-8.49
8th	Packaging	-1.26^{***}	-6.7	-2.03^{***}	-19.3
9th	Skin fuzziness	-1.40^{***}	-7.82	-1.63^{***}	-15.32
Number of parameters		9		9	
Number of observations		2528		2528	
Final log likelihood		-2,904.739		-3,014.584	
Adjusted R^2 (%)		28.4		25.7	
CAIC		5,889.0		6,108.7	

[1]Relative BW score is the difference between texture BW score and BW score of each other attribute.

Model 1 and 2 present similar preferences. A linear regression between parameters, from model 1 and 2, is estimated and the following function is obtained: $y_{most} = 0.53 + 0.91x_{least}$, with all parameters statistically significant at 1% and adjusted R^2 of 91.7%. Where, y_{most} and x_{least} are the attribute's relative importance, measured from statements of the most and the least important attributes in the choice set, respectively. If both functions would represent exactly the same preferences, the constant term should be zero (in Cartesian coordinates, the function would pass through the origin coordinate) and the parameter of the least important alternatives should be one (it would imply that the parameter of model 1 and 2 would be equal). Although model 1 and model 2 are not exactly equal, they can be considered that they represent the same preferences. The difference between model 1 and 2 can be explained by the consumers' different ability to state the most (best) and the least (worst) important alternatives, as reported by Sawtooth (2007).

Next two models, model 3 and 4 (Table 4.10), estimate the attributes' relatives importance taking into account the most and the least important alternatives choices at the same time, i.e., they consider that consumers have chosen two alternatives in each choice set that maximize the utility (importance) difference. Model 3 corresponds to the traditional way of estimating a best-worst model and model 4 incorporates a new term (scale factor) that measure consumers' ability to choose the most and least important alternatives.

In the traditional way, model 3, considers that consumers have the same utility function for the most and for the least important alternatives and that they have the same ability to state those alternatives. The dummy variables are coded 1 for the most important alternative and -1 for the least important alternatives in the estimation matrix, and the utility function is estimated only in one survey.

Model 3 has worst statistical performance in comparison to model 1 and 2, however it solves the problem of unbalanced information. Its adjusted R^2 values are between model 1 and 2 values, but its log likelihood and CAIC are smaller and bigger, respectivelly. T-values of attributes with extremes importance have higher performance than from model 1 (high importance) and model 2 (low importance). Model 3 has similar results of model 1 with respect to rank order for taste, ripeness, colour and texture and all other attributes change their ranks in one position. In relation to model 2, only colour, texture and prices do not coincide.

Model 4 jointly estimates data from the most and the least important alternatives, but it takes into account that those choices come from different surveys. This estimation process is known as data pooling when stated and revealed preferences are studied.

In data pooling, each data source should be used to capture significant aspects of the choice process. For example, the most important alternatives choice data provide better accuracy for the most important attributes, while the least important alternatives choice data provide more precision for the least important attributes and jointly they can provide more accurate models for extreme important alternatives.

Analytically, it is assumed that choice processes error terms of the most and the least important alternatives chosen are IID extreme value type 1 (EV1) within both data sources that are associated, respectively, with scale factor λ^b and λ^w. An important property in the MNL model is that the scale factor is inversely related $\left(\sigma^2 = \pi^2/6\lambda^2\right)$ to the error term variance (Louviere *et al.*, 2000). Thus, higher scale factors are achieved from better fit models, which present smaller variance in their parameters.

Table 4.10 Relative importance of PDO Calanda peaches attributes estimated by Multinomial Logit (MNL) models without and with relative scale factor

		Model 3 BW alternatives without scale factor		Model 4 BW alternatives with relative scale factor	
Rank	Variables	Parameter	t - test	Parameter	t - test
1st	Taste	1.99***	24.42	2.17***	16.03
2nd	Ripeness	1.26***	17.17	1.36***	14.11
3rd	Smell	0.59***	7.73	0.62***	7.47
4th	Price	0.33***	3.99	0.32***	3.65
5th	Colour	0.04ns	0.45	0.04ns	0.42
6th	Produced in bags	-0.68***	-8.10	-0.71***	-8.08
7th	Peach size	-0.85***	-11.11	-0.87***	-10.98
8th	Skin fuzziness	-1.41***	-18.39	-1.43***	-17.95
9th	Packaging	-1.76***	-22.66	-1.78***	-22.10
Relative scale factor				0.91**	-1.83
Number of parameters		9		10	
Number of observations		5,056		5,056	
Final log likelihood		-5,958.54		-5,957.01	
Adjusted R^2 (%)		26.7		26.7	
CAIC		12,002.8		12,009.3	

It is not possible to spot a scale factor within a particular data source because the expression $\left(\beta_k \lambda^b\right) = \left(\beta_k \lambda^w\right)$ can not be solved. However, when there are more than one data source it is possible to estimate a relative scale factor by normalising one scale, in this case $\left(\lambda^w \equiv 1\right)$. Consequently, the estimated log likelihood function is $\psi\left(\beta, \lambda^b\right)$, which depends of jointly parameters (the restriction is that parameters are equal) vector and the relative scale factor $\left(\lambda^b\right)$ of the most important alternatives.

Model 4 estimations are shown in Table 4.8. Model 4 has slight worst fitting than model 3. Its final log likelihood has smaller negative value, but the CAIC is few higher and the adjusted R^2 is the same. Both models offer equal ranking attributes, but model 3 provides better attributes accuracy (with exception to colour t-value, all t-values are higher than in the model 3).

The relative scale factor of the most important chosen alternatives is 0.91, statistically significant at 5%. Its value is smaller than the normalized scale factor $\left(\lambda^{w} \equiv 1\right)$ because model 1 fits better than model 2. It also allows saying that the variance of the most important alternatives choices is 4.6% smaller[10] than the variance of the least important alternatives choices. It may explain why model 2 has worst fitting than model 1.

4.4.2.2 Best-Worst Latent Class clustering

Rarely is possible to satisfy all consumers treating them as if they were the same. The PDO Calanda peaches market is also diverse and there are consumers with different needs and wishes, which define different market segments. Therefore, identifying and measuring market segments assures that some of these different needs and wishes are met.

One advantage of marketing segmentation is to offer specific products to target consumers. If companies use market segments information and they plan their marketing strategies accordingly, they can get competitive advantage in relation to other companies that elaborate global strategies. Advertising and promotion costs may decrease when they are inclined to target groups (Dodd and Bigotte, 1997). It is relevant for governments to promote fruit consumption and to improve healthy habits.

Latent class analysis (LCA) is a statistical method employed to identify homogeneous, mutually exclusive groups, in a heterogeneous population. In marketing, these groups are market segments with consumers who have similar preferences and they may also be known as clusters. In this research, it is hypothesized that complex consumers' preferences of PDO Calanda peaches attributes within the sample may be identifiable and measured in many smaller behavioural groups. In the market there are consumers mainly concerned with prices or packing or peaches size, as well as others who are not particularly bothered by those issues. Each behavioural group has other characteristics which tend to vary among groups but not within groups.

[10] The ratio between the variances of the most and the least important alternatives choice, is calculated as follows: $\frac{\sigma_b^2}{\sigma_w^2} = \frac{\pi / 6\lambda_b^2}{\pi / 6\lambda_w^2} = \left(\frac{\lambda_b}{\lambda_w}\right)^2 \approx \left(\frac{\hat{\lambda}_b}{\hat{\lambda}_w}\right)^2 = \left(\frac{0.91}{1}\right)^2 = 0.954$ and the difference is (1-0.954) = 0.046 or 4.6%.

The Latent Class Analysis has been selected in this work because it presents several advantages over other methods. According Shen (2009) and Green and Hensher (2003), for their data, Latent Class models statistically perform better than Mixed Logit models and, on top, Mixed Logit models claim specific assumptions for parameters distribution.

Orme (2007) simulates data and contrasts the performances of K-means clustering and Latent Class clustering. When there is homogeneity of random responses errors within segments both methods have the same performance, but when the data are heterogeneous within the cluster, latent class provides more stable results for repeated solutions and it produces groups closer to the right size.

Cohen (2003) lists the major advantages of Latent Class Analysis in comparison to Two – Stage[11] or Tandem Analysis. Basically, Latent Class Analysis uses original data and data transformation is not necessary; it fits a statistical model to the data, allowing to test uses and heuristics test to check model fit; diagnostic information reports if the segmentation model is over fit; and probabilities are assigned to each subject to belong to each cluster. This probability allows further assessments of model fit and identification of outliers. This author concludes saying that Tandem Analysis is uniquely a descriptive analysis while Latent Class can be used for descriptive analysis as well as for predictions.

As mentioned, Latent Class assigns a probability level to each consumer to belong to each market segment while other methods consider that a subject belongs to only one segment. This characteristic of Latent Class is closer to assumptions of consumer behavior theories because people do not always behave only one way.

4.A) Latent Class model

Econometrically, for the Latent Class model, the choice probability that a subject *q* of class *s* chooses alternative *i,* as the most or the least important attribute, from a particular set *J*, which has *j* alternatives is expressed in equation 4.5.

[11] Two-stage analysis uses rating scale items and annalists first reduce data, with Factor Analysis, to get a small number of underlying dimensions and then factor scores are included in a Cluster Analysis. In this case, K-means Cluster Analysis is most used (Cohen, 2003).

$$P_{iq|s} = \frac{\exp(\beta_s' X_{iq})}{\sum_{j=1}^{J} \exp(\beta_s' X_{jq})} \qquad s = 1,\ldots,S \qquad 4.5$$

Where β_s' is the parameter vector associated with the vector of explanatory variables X_{iq}. The explanatory variables are coded as +1 when they represent choices of the most importante attribute and -1 if choices are the least important attribute. When the attribute is not available to be chosen, its explanatory variable takes value 0. Latent Class model simultaneously estimates equation 4.4 and predicts the probability H_{qs} as individual q being in class s. Thus, the unconditional probability of choosing the alternative *i* is given by equation 4.6.

$$P_{iq} = \sum_{s=1}^{S} P_{iq|s} H_{qs} \qquad 4.6$$

The basic latent class estimation process works: first, selecting random estimates of each group's utility values. The second step is estimating the relative probability of each respondent belonging to each group by his/her data set. The third step is estimating log weights for each group using the individual probabilities as weights. The second and third steps are repeated until the log-likelihood fails to improve by more than a small amount (Orme, 2007). This repetition is called interactions and in this analysis 100 interactions have been calculated.

The goodness of fit for a particular model (number of classes or behavioural markets segments), is determined by the Constant Akaike Information Criterion (CAIC). It is broadly used to decide the optimum number of clusters. Laska *et al.* (2009), Wen and Lai (2010), Chrysochou *et al.* (2010), Ruto *et al.* (2008) and Scarpa *et al.* (2009) use also this criterion to estimate the optimum number of segments.

4.B) Chosing the number of cluster of consumers

The number of groups of consumers with different preferences is exogeneous to the estimations procedure. To determine the appropriate number of groups or clusters are generally based on log likelihood of the model and penalized for the increase in the number of parameter to be estimated as well as the number of observations. A general formulation is C = -2L + kJ, where L is the value of the log-likelihood function at the convergence; J is the number of estimated parameter in the mode and k is a penality constant. Sawtooth (2007) suggests to calculate the number of estimated parameters by $(ng + g - 1)$; where number of market segments is (g) and (n) is number of independent parameters estimated per market segment. For k = 2 it is obtained Akaike Information Criteria (AIC); for k = ln (N)+1 it is obtained the consistent AIC (CAIC) and for k = ln(N) it is obtained the Bayesian Information Criteria (BIC).

The AIC is reported to be biased in reation to overestimate the number of preference classes, whereas the BIC is not (McLachlan and Peel, 2000). According to Sawtooth (2007), there is not a theoretical basis for this statistic, but simulated data has demonstrated that it may be a useful criterion for choosing the optimum number of segments.

4.C) Latent Class estimation

The Sawtooth Latent Class Analysis software is employed. In the data analysis for Latent Class estimation, 10 possible scenarios are calculated and compared. The first scenario considers that the market behaves in the same way, i.e., hypothetically there is just 1 market segment; in the second scenario there are 2 markets segments; up to the 10^{th} scenario with 10 market segments. For each scenario one the CAIC value, BIC value and AIC value are estimated and the best number of market segments is estimated.

AIC indicates that consumers can be grouped in more than 10 clusters by PDO Calanda peaches attributes' importance in Zaragoza while BIC states that there are 9 clusters and CAIC points out that this number is 5. Following Scarpa *et al*. (2009), it is possible to say that there are between 5 and 9 clusters. Those authors also advise to select the number of clusters who offer the best preferences description, in this case 5 clusters. Graphic 4.2 shows the attributes importance in each market segment. For estimation process, texture is considered the attribute of reference and its value is taken as zero and other parameters represent the difference of importance in relation to texture.

Table 4.11 Model fitting according with the number of clusters

Number of clusters	Log likelihood	AIC	BIC	CAIC
1	-5958,5	11935,1	11993,8	12002,8
2	-5764,0	11566,0	11690,1	11709,1
3	-5628,3	11314,7	11504,0	11533,0
4	-5547,6	11173,2	11427,8	11466,8
5	-5481,5	11061,0	11380,9	**11429,9**
6	-5435,1	10988,2	11373,4	11432,4
7	-5386,4	10910,9	11361,3	11430,3
8	-5340,5	10838,9	11354,7	11433,7
9	-5295,5	10769,0	**11350,1**	11439,1
10	-5272,8	10743,6	11389,9	11488,9

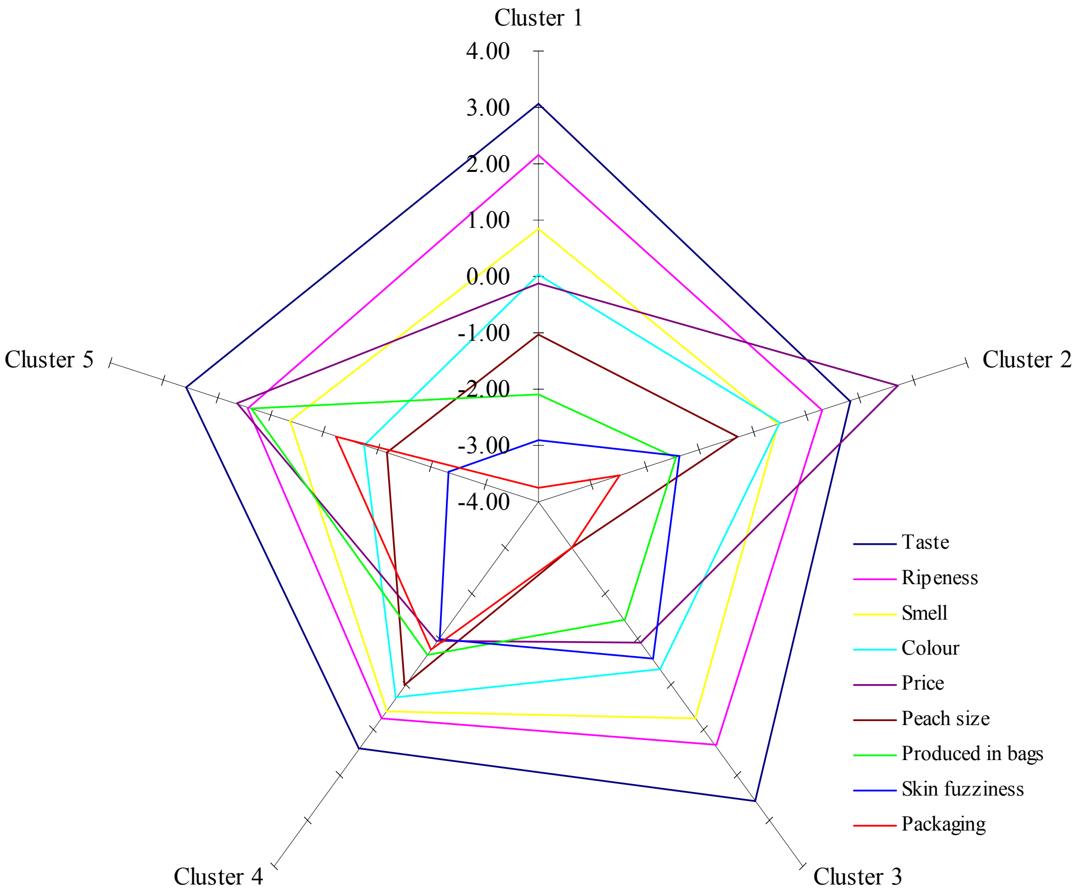
Note: Number of observations = 5.056 and of parameters = 9.

The numbers in bold indicates the best fitting model

In Latent Class Analysis the number of people in each cluster is calculated summing the probability of each person belonging to this cluster. Thus, it is estimated that 88 consumers belong to cluster 1. It is the largest market segment because it has 27.8% of the total market. The second largest market segment is cluster 4, with 71 consumers (22.3%), and it is followed by cluster 3 (18.6%), cluster 2 (16.0%) and cluster 5 (15.3%).

Although consumers from cluster 5 give great importance to PDO Calanda peaches' price on their purchase decision, consumers from cluster 2 consider price as the most important aspect when they buy this kind of peaches. Taste takes the second rank in order of importance only in cluster 2. Ripeness is third in both clusters and in second position in other clusters. Consumers from cluster 5 can be characterized by their judgement about production in bags, packaging as more important and colour importance as less important. Producing PDO Calanda peaches in bags is ranked in 4th position whilst for others it takes between the 7th and 9th position. Colour is considered by consumers as the 8th most important attribute while for others it is considered as 4th or 5th most important.

Graphic 4 2 Cluster means of PDO Calanda peaches attributes relative importance



On the other hand, cluster 4 represents those consumers less sensitive to price. Price is the second least importante attribute when they purchase PDO Calanda peaches. The other characteristic that characterize consumers from this cluster is peach size importance. This attribute is more important in this cluster than in others (5th position in importance).

Consumers in cluster 3 can be distinguished from others because they give more importance to texture and skin fuzziness. In this cluster texture is the 4th position in importance while in other clusters is in 5th position (cluster 1) or in 6th position. The greatest difference is found for skin fuzziness, which is in 6th position and in others takes the 8th.

Regarding cluster 1, there are not huge differences in relation to other clusters. The order of texture (5th), price (6th) and skin fuzziness (9th) do not coincide with their rank in other clusters and they are not located as extreme positions. So this cluster can be characterized by the average preference.

4.5 Final remarks

This chapter provides by different approaches, estimations about the relative importance of the 10 main PDO Calanda peaches' attributes by using Best-Worst Scaling (BWS). This method has several advantages over other methods, especially in relation to the discrimination power among attributes and no scale bias. This is the reason why this method is becoming more popular in social sciences.

The relative importance of attributes have been analysed by BW scores and with the Multinomial Logit (MNL) model. In both cases, the most and the least important choices have been assessed separately and jointly. Taste is the most important attribute of PDO Calanda peaches and ripeness is the second. This result has been found in each analysis and from different approaches (most and least important attributes).

For other attributes, the rank order varies across different approaches. So, which model provides the best relative attributes importance? This question is answered when model 1 (with the most important alternative), model 2 (with the least important alternatives) and model 3 and 4 (with the most and the least important alternatives) are compared. Model 1 provides greater accuracy for the most important attributes than model 2 and model 2 gives greater precision for the least important attributes than model 1, but model 3 and 4 are more precise for the most important attributes than model 1 and for the least important attribute than model 2. It means than taken the most and the least important attributes together is better than isolated.

Comparing the attributes rank order between model 3 and 4 (Table 4.8) and from the ratio B/W or relative importance (Table 4.3), there is only a change of ranking for colour (4^{th} most important attribute in BW scores and 5^{th} in the MNL model) and price (5^{th} most important attribute in BW scores and 4^{th} in the MNL model). This difference is nor significant because, according to the homogeneous sub-sets (Table 4.4), colour, price and texture have the same weight on consumer purchase decisions. These empirical results converge to the conclusions made by Marley and Louviere (2005) that results from MNL models and BW scores are equivalent.

Then, on average, the preference order for PDO Calanda peaches attributes is: taste $\succ$ (it is preferable to or, in this case, it is more important than) ripeness $\succ$ smell $\succ$ colour ~ (it is indifferent to or, in this case, it is same important than) price ~ texture $\succ$ produced in bags ~ peaches size $\succ$ skin fuzziness $\succ$ packing. This rank order is very similar to that estimated by Cembalo *et al.* (2009). They estimate that, for German peaches consumers, the most important attribute is taste and it is followed by appearance, ripeness, price and packaging (here are listed just the common attributes of both studies). It states that peach attribute preferences in Europe may be similar and it is necessary to pay attention especially on peaches organoleptics qualities, especially taste, to increase peaches consumption.

Two attributes call the attention, taste and price, when heterogeneity of preferences is taking into account. Besides being important, taste has low variance through consumers' preferences (Graphic 4.1). Exceptionally, taste takes the second most important position in cluster 2 (market segment 2), but in others clusters it is the most important attribute. Therefore taste can be considered a factor for a global strategy while price not. Globally, price has an intermediate importance, but it has the greatest variance of consumers' preferences.

In cluster 2, which represents 16.0% of the market, taste is the most important aspect of PDO Calanda peaches at purchase and it is the second most important in cluster 5 (15.3% of market). In other markets segments, less sensitive to price, it is important to stress the peach size relative importance in cluster 4 (22.3% of market) and skin fuzziness and texture relative importance in cluster 3 (18.6% of market).

The Latent Class Analysis is a good statistical tool to estimate market segments and it is appropriate with behavioural theories. However, the number of markets segments, determined by CAIC and relative chi squares, may have good statistical properties, but sometimes the interpretation of results can become complicate. Laska *et al.* (2009) suggest that the number of classes (market segments) should allow results interpretability, according to theory and previous findings in the scientific literature.

Regarding the traditional technique of producing PDO Calanda peaches in bags, it is the 6th most important attribute, on average. However, consumers who belong to cluster 5 are those who give the greatest importance to this attribute (4th position) and they represent 15.3% of market. Producing peaches in bags is the only PDO Calanda peach characteristic that regular and sporadic consumers disagree. Regular consumers give more importance to this attribute than sporadic, which indicates that they might have higher knowledge about its benefits (social impact and healthy concerns). Older consumers also give more importance to produce PDO Calanda peaches in bags.

The correlation between produced in bags and other attributes is not significant in most cases. Nevertheless, correlations between colour and skin fuzziness are highly negative. It means those consumers who appreciate this production technique are more tolerant towards skin fuzziness and colour (remember that PDO Calanda peaches do not have red coloured skin which may be desired for some consumers).

It has been observed that consumers consider choice tasks as a challenge for their cognitive process. They think that they are judged according to their consistent responses (one statement would not contradict the previous one). Some consumers are bored because the attributes are repeated many times across all choice sets. These limitations have also been reported by Cohen (2009), who indicates that these perceptions happen when there are less than 15 attributes in the experiment. As a recommendation for future studies with BWS is that a larger number of attributes in the experiment could be introduced and/or employing Adaptive Maximum Difference Scaling Approach (A-MaxDiff).

Orme (2006) develops the adaptive approach for BWS (MaxDiff) questionnaires. This approach is based on Adaptive Conjoint Analysis (ACA) and it varies the layout of choice sets in different stages. As the level of difficulty increases gradually with choice tasks because consumers get tired, thus A-MaxDiff decreases the number of alternatives in each choice set. In relation to the MaxDiff approach, this author concludes that A-MaxDiff provides similar attributes weights; it yields more accurate estimations of most important attributes, but less accurate estimations of least important attributes; it takes less time to be completed; and it is perceived to be more enjoyable.

The methodology of Best - Worst attribute choice experiments, demands a great effort by consumers to compare alternatives and it discriminates the attributes importance on consumer purchase decisions better than other available methodologies to study preferences. Meanwhile, the BW experiment has the particularity of measuring the relative importance of attributes and not their absolute importance. For example, it could happen that there was a set of attributes that influence consumers strongly on their purchasing decisions but not so to other group of consumers, but their relative importance for both consumers could be the same, then the BW Score would be the same for these two kinds of consumers.

In the case that there would have been interesting not to know just the relative importance but also the absolute importance of attributes, it would be necessary to include additional questions in the questionnaire. In this regard, future work could be developed to evaluate the relationships between attributes relative importance, assessed by BW Scaling, and their real importance degrees on consumer choice, for example, assessed by rating tasks.

Chapter 5: Preferences, at sample level, for late season peaches' attributes-levels

5.1 Introduction

As it is described in Chapter 1, PDO Calanda peaches are produced in the Calanda area, which offers special conditions to produce high quality late season peaches. Consumers can perceive peaches produced in the Calanda area as a product of higher quality than peaches produced in other areas. However, the Regulatory Council (RC) of the PDO Calanda peaches was created in 1999 in order to guaranty of consumers the special quality of those peaches. Hence, peaches that accomplish the quality standards receive the PDO Calanda peaches brand label that certifies the product authenticity and quality. The quality differentiation as well as its control implies higher costs for the production system.

It is expected that higher costs might be compensated by premium prices when a PDO product is sold. Until now, few studies have been carried out to estimate the brand value of the PDO product. Polo and Albisu (2010) find that around of 40% of wholesalers, who trade with this product, think that the premium price is around 20% higher than peaches without PDO, *ceteris paribus*. At consumer level, there is not any study to estimate the PDO Calanda peaches brand value (the premium price) and the amount consumers' value, in Euros per kilograms, the Calanda production area.

It has also been described that PDO Calanda peaches are big size fruits. Increasing the size of peaches demands a great effort for growers because they have to make the "aclareo". The "aclareo" consists of taking off almost 70% of fruits from the tree at its beginning development stage. As a consequence, growers have to spend greater resources on labour and the plant decreases of the productivity.

Nowadays, society is changing. Women are working more often outside home and, as a result, people are less willing to spend time preparing dishes. Companies adapt to those changes as market opportunities and those which are able to develop more suitable products for new consumers needs and wishes may increase their profits.

The convenience of fruits and vegetables is increasing with new packing types. Basically, packaged fruits maintain their quality for a longer period of time. It is possible to find PDO Calanda peaches sold in open boxes (in bulk) and normal packing (trays with film) in super/hypermarkets in Zaragoza city. Consumers can select the most preferable fruits when peaches are sold in bulk and touching peaches is the way they obtain more information about peaches quality, such as their texture. When peaches are packaged consumers lose that information, but they can get other benefits, such as higher convenience and a product that can be stored for longer time, especially with active packing.

Active packing is a new process when the plastic film which surrongs peaches receives treatments with natural products and is conditioned in packing with controled atmosphere. Those modifications avoid microorganism attacks, diminish fruit metabolism and it increases its shelf life.

There was not found any peach conditioned in active packing in Zaragoza city. Its impact on consumers purchase decisions is still unknown and the lack of any previous market study about this new process increases the economics agents' uncertainty. More information is desired for more effective marketing strategy plans. One objective in this chapter is to value the probable impact of introducing active packing in the local market.

As mentioned in the Chapter 1, PDO Calanda peaches growers spend a great amount of resources for improving peaches sizes. They carry out the "aclareo", which is labor intensive demanding and it decreases in productivity (kg/ha). However, they expect that their effort will be compensated by higher prices.

Consumers who participated in the Focus Group (Chapter 2) said that they whish large size peaches, however some of them expressed that some peaches in the market were too large. This part of the study deals with the best peach size estimations, for all market and segments. Thus it is estimated how much, throught the marginal Willigness-to-Pay (WTP), consumers from the city of Zaragoza value the late season peaches quality aspects, such as: the generic PDO Calanda peaches' brand, production area, peaches sizes and different types of packing. It is described the peach with the best and worst profiles, that is, with the best and the worst levels of attributes, respectively. It is estimated the maximum WTP for peaches with the best and the worst profiles.

In order to achieve this aim, it was applied a survey in 2008 and another in 2009. The first survey carried out a Multiattribute Descrete Choice Experiment where consumers had to point the best and the worst late season peaches in each choice set and, in the last survey, they built the best and the worst late season peaches profiles by stating the best and the worst levels of each attribute. They also mentioned the maximum WTP for each profie.

The answers from the first survey (2008) are analysed with different discrete choice models. It is estimated the effect of conditional and unconditional situations on model fitting as well as the effect of increasing the number of observations and the number of alternatives in the choice set. The proposed model that has the highest number of alternatives and observations is the Bottom-up.

The Bottom-up model is an alternative method suggested by Louviere *et al.* (2009) to allow estimations of marginal utilities at individual level. Up to now, this model was only used to obtain additional information in order to estimate a greater number of parameters that are statistically different from zero. However, it has never been compared with other models performance, at sample level as well as at individual level.

This chapter is structured as follows: first, the theoretical frameworks of several discrete choice models are presented and, then, the experimental design is exposed. The results of marginal utility are offered for the entire market and for the different market segments. The heterogeneity of consumers' preferences is dealt by interaction effects between each peach and consumers characteristics. It is calculated the WTP, once having the marginal utility of each peach's characteristic. Finally, the WTP is weighted by the available information from the 2009 survey.

5.2 Theoretical framework

Stated preference methods are used in many areas, such as marketing, health and environmental economics. This methodology is useful because it allows measurements of consumers' preferences in an economic dimension, i.e., in monetary scale, with goods that never were deliberated at markets or with those goods that do not have markets, such as environment and public goods.

In relation to real preferences which are observed, for example by scanner data, stated preferences are obtained from applied questionnaires. The sample size, measured by the number of available questionnaires or consumers who participated in the survey, is closely and positively linked with estimations' accuracies. The survey cost is also closely and positively related with the number of questionnaire as well as the time to answer it.

Stated preferences are often studied with Discrete Choice Experiments (DCE). DCE are very popular because, as consumers have to choose alternatives among a set of available options, they simulate purchases conditions. In Traditional Discrete Choice Experiments (TDCE), consumers only choose the best alternative, i.e., like in a purchase situation, they state the alternative that they would buy in a real market situation. One of the TDCE limitations is the number of observation provided per respondent, which is equal to the number of presented choice sets.

Ranking experiments have been proposed, in order to increase the number of observations per consumer, without an extra cognitive effort that would decrease responses quality. Consumers are asked to order all alternatives from the best to the worst option in the set of available alternatives of ranking experiments. Ranking data give new observations through exploding estimations and, as a consequence, estimations get more accurate with the same sample size.

Finn and Louviere (1992) propose a new DCE where consumers state the best and the worst alternatives in each choice set. According to those authors, people have better ability to identify extreme options and then alternatives from a choice set can be, fully or partially ordered, more consistently following consumers' preferences.

In the next sections, the theoretical framework of Traditional, Ranking and Best-Worst Discrete Choice approaches are presented. The Best-Worst Discrete Choice Experiment is summarized as well as the BW Choice Experiment and the Bottom-up model.

5.2.1 Several Discrete Choice Models

5.2.1.1 Traditional Discrete Choice Experiment

In this study, the Traditional Discrete Choice Experiment (TDCE) presentes some choice sets to respondents and they have to select one option, the best alternative. It is based on Thurstone`s hypothesis about human decision making made in 1927, which is called Random Utility Theory (RUT). This theory makes the supposition that the person (q) has a determined utility (U_{iq}) with the alternative (i) and this utility can be separated in a systematic component (V_{iq}), that can be observed and measured by the researcher, and the random component (ε_{iq}), that captures the measurement errors of the model (Equation 5.1).

$$U_{iq} = V_{iq} + \varepsilon_{iq} \qquad 5.1$$

Additive functions consider that total utility of the systematic term is influenced by all products' characteristics (*k*). These influences are captured by the β s of Equation 5.2, where the total utility of alternative *i* is the sum of the partial utility from each attribute-level. In this experiment, each alternative is a hypothetical peach profile built from different combination of attributes-level, and it is known as the multi-attribute choice experiment.

$$V_{iq} = \sum_{k=1}^{K} \beta_k X_{ikq} \qquad 5.2$$

Assuming human rational behaviour, individual *q* will choose the alternative *i*, among *J* alternatives, if only if, its utility is higher than the utility of other alternatives. More formally it is expressed by Equation 5.3, where *A* represents the set of available alternatives.

$$V_{iq} \geq V_{jq} \text{ for all } j \neq i \in A \qquad 5.3$$

The probability of this occurring event is:

$$P_{iq} = \Pr ob\left(U_{iq} \geq U_{jq}, j = 1,2,..., J\right)$$

$$P_{iq} = \Pr ob\left(V_{iq} + \varepsilon_{iq} \geq V_{jq} + \varepsilon_{jq}, j = 1,2,..., J\right)$$

$$P_{iq} = \Pr ob\left(V_{iq} - V_{jq} \geq \varepsilon_{jq} - \varepsilon_{iq}, j = 1,2,..., J\right) \qquad 5.4$$

Thus, the probability of chosen alternative i over other J alternatives, $(j \neq i)$, is proportionally to the utility provided for each alternative. Assuming that the stochastic term has a normal distribution and it is identical and independently distributed (IID), Equation 5.4 can be transformed into Equation 5.5.

$$P_{iq} = \frac{\exp(V_{iq})}{\sum_{i=1}^{J} \exp(V_{jq})} \text{ for } i = 1,2,...,J \qquad 5.5$$

Thus, considering that there were three alternatives in a choice set, for example, alternatives A, B and C; and that respondent's preference was A > B > C, i.e., alternative A is preferable to alternative B, and alternative B is preferable to alternative C. In this case, the probability of respondent to select alternative A over available alternatives can be written as Equation 5.6.

$$\Pr(A > B, C) = \frac{\exp(V_A)}{\sum_{j=A,B,C} \exp(V_j)} \qquad 5.6$$

This experiment provides information about the alternative A. Knowing that alternative A is preferable to all other alternatives, it is not possible to make any statements if alternative B is preferable to alternative C or otherwise. In this case, the number of observation per respondent is equal to the number of presented choice sets. The effect of increasing the number of alternatives in the choice set decrease the probability to chose A as the best option; however, it also results in more accurate estimations.

5.2.1.2 Ranking Discrete Choice Experiment

In the Ranking Discrete Choice Experiment (RDCE), respondents are requested to order, from the best to the worst, all available alternatives the each choice set has. Using the last example of three alternatives in each choice set, the ranking task provides two times the sequence about ordering information than a TDCE. In this case, all alternatives follow the same order (A > B > C), while in the TDCE task there are two possibilities to order the: A > B > C or A > C > B. The difference of information amount is positively related to the number of available alternatives in the choice sets.

The estimations in ranking experiments are known as exploded process. According to Chapman and Staelin (1986) the exploded process occurs when the probability of a ranking task is calculated. The exploded process occurs when there is a factorization of the entire choice experiment in smaller choice sets, which add new observations. Thus, the probability of A > B > C is equal to the Multinomial logit (MNL) of choosing A as the best option from a set {A, B, C} times the (MNL) of choosing B as the best option from the remaining {B, C} (Equation 5.7). The number of observations per respondent increases two times in this example. Estimations become more accurate in the Ranking DCE than in Traditional DCE but, Equation 5.7 calculates the probability of ordering alternatives while Equation 6 provides only the probability of alternative A to be chosen as best. The log likelihood of Equation 5.7 is smaller.

$$\Pr\ (A > B > C) = \frac{\exp(V_A)}{\sum_{j=A,B,C}\exp(V_j)} * \frac{\exp(V_B)}{\sum_{j=B,C}\exp(V_j)} \qquad 5.7$$

5.2.1.3 Best-Worst Discrete Choice Experiment

Best-Worst Discrete Choice Experiment (BWCE) is also based on the Random Utility Theory (RUT). Finn and Louviere (1992) present the first publication dealing with this technique, but the formal statistical and measurement properties are presented by Marley and Louviere (2005). Essentially, in best-worst choice tasks, respondents are requested to state the best (the most preferable or important) and the worst (the least or less important) options in a choice set.

Formally, it is assumed that subject (q) identifies and calculates the utility difference for every pair $(U_{q,u} - U_{q,v})$ of available options in a choice set and it selects that pair that maximizes utility differences between alternatives $(U_{q,s} - U_{q,t})$. Note that, besides to maximize the utility difference, respondents are also stating which alternative are the best and the worst. There are two kinds of components in discrete choice models, the vector of non-stochastic, $V_{q,s}$ for the best and $V_{q,t}$ for the worst alternatives, which can be recognized by the analyst, and the unobserved error term $\varepsilon_{q,it}$. It is imposed that this error term is independently and identically distributed (IID) with extreme value type 1. Equation 5.8 models the choice decision for a Best-Worst experiment.

$$Y_{q,st} = U_{q,s} - U_{q,t} = V_{q,s} - V_{q,t} + \varepsilon_{q,st} \quad \text{for } s,t = 1,...,J \quad \text{and } s \neq t \qquad 5.8$$

In the Best-Worst choice task, with a choice set size of three alternatives, answering the best and the worst options only once is enough to obtain a full ranking of alternatives.

In this study, three approaches of Best-Worst Discrete Choice Experiment (BWDCE) are dealt. One is the Simultaneous BWDCE, which considers that consumers make their choice decision about the best and the worst alternatives in the choice set only once (simultaneously). The other approach, which is proposed by Lancsar and Louviere (2008), considers that respondents select first the best option and, then, the worst alternative in the choice set and it is called Sequential BWDCE.

The last approach is an alternative method proposed by Louviere *et al.* (2009) in order to improve the number of individual observations. They call this approach as the Bottom-up model. This model does not make any assumption about the choice decision (sequential or simultaneous), but it was originally proposed to be carried out with Best-Worst DCE because consumers have better ability to identify extreme options.

As the number of observations per respondent is low, the intention of these authors was to use a greater ability to identify alternatives by BW tasks to diminish the choice variance, and as a consequence, increase the number of parameters statistically different from zero.

5.A) Sequential Best-Worst Discrete Choice Experiment

Equation 5.9 represents the probability of ranking the three alternatives by Sequential BW approach. Thus, the probability of A > B > C is equal to the MNL of chosen the alternative A as the best option from a set {A, B and C} times the MNL of chosen the alternative C as the worst option from a set {B, C}. The negative value of the second element represents the Best-Worst coding system. It consists to multiply explanatory variables coding by + 1 when the choice presents the best alternative and by -1 when the choice is the worst alternative. Equation 5.9 is based on Lancsar and Louviere (2008).

$$\Pr\,(A > B > C) = \frac{\exp(V_A)}{\sum_{j=A,B,C} \exp(V_j)} * \frac{\exp(-V_C)}{\sum_{j=B,C} \exp(-V_j)} \qquad 5.9$$

Note that, the first elements (MNL) from the RDCE and the first element (MNL) from the Sequential BWDCE are the same. In both cases the MNL expresses the probability to choose A as the best option from the set {A, B, C}. Although the second elements (MNL) from Equations 5.7 and 5.9 do not represent the same decision, in Equation 5.7 it refers to the probability of choosing the alternative B as the best while, in Equation 5.9, it is the probability of choosing the alternative C as the worst.

Comparing the results from the Ranking DCE and Sequential BWDCE models is relevant because it can clarify the consistency of the BW coding system results. The consistency of the coding system can be understood as the indifference of using information of the best as well as best-worst alternatives. For example, if there were 2 alternatives (A and B) in the choice set (paired model), and a consumer states that alternative A is better than alternative B. Saying that alternative B is worst to A, is the same (A>B = B<A). According to the BW coding system, if one parameter is coded with +1 for the best alternative it is the same parameter as it is coded by -1 for the worst alternative. If this system provides consistent results, then paired estimations from the best or from the worst options should be the same. This coding system can also be checked with a DCE with 3 alternatives in each choice set. The last decision following Ranking DCE and Sequential BWDCE is equal than the example of paired model.

5.B) Simultaneous Best-Worst Discrete Choice Experiment

Equation 5.10 represents the probability of ranking three alternatives following the Simultaneous Best-Worst Discrete Choice Experiment (BWDCE). Thus, the probability of A > B > C is equal to the MNL of choosing A as the best option from a set {A, B, C} times the MNL of choosing C as the worst option from a set {A, B, C}. In this case, the number of observations is double than in the TDCE and in each choice there is the same number of alternatives. Thus, the amount of information is also the double. This approach is also called as marginal model by Flynn et al. (2007), but they dealt with this model in a best-worst scaling of attribute-level, which measure the preferences for attribute and their levels in a same scale.

$$\Pr(A > B > C) = \frac{\exp(V_A)}{\sum_{j=A,B,C}\exp(V_j)} * \frac{\exp(-V_C)}{\sum_{j=A,B,C}\exp(-V_j)} \qquad 5.10$$

With respect to the Ranking DCE and the Sequential BWDCE, estimation of the first decision in the Simultaneous BWDCE is the same in the three models because the MNL of choosing A as the best option from a set {A, B, C}. In the last choice, the number of alternatives in the simultaneous BWDCE increases 50% in relation to other models.

5.C) The Bottom-up method

5.C.1) The Bottom-up and other methods for individual preferences

The Bottom-up model has been proposed by Louviere *et al.* (2009) to model the choices of individual decision-makers. According to them there are several advantages for the Bottom-up model in comparison to other traditional methods, called as Top-down models. They classified Top-down models as those who can be either estimated directly (Paired model as the extreme example to model individual decision-makers), or indirectly (Hierarchical Bayes) and random effect models (Mixed logit and Latent Class models).

Pihlens and Louviere (2004) estimate a model with choices about colours undertaken by a single person. They used the Paired model approach to measure the colour perceptions error for this person. In order to achieve reliable parameters 100 choice sets were demanded, with 2 alternatives each one. Although choice sets with 2 alternatives can be considered an easy task, the total number of choices sets to model individual decisions was considered too large for them, especially if this method has to be employed for marketing studies. Respondents might get exhausted with choice tasks, responses quality would decrease and the survey cost would be too expansive. The advantage is that, this experiment allows direct error measurement.

Louviere *et al.* (2009) affirm that the Adaptive Choice Methods (ACM), such as polyhedral methods, is one option to diminish the number of choice sets to estimate directly the individual preferences. In this method, previously to choice tasks, respondents make statements with the objective to select the dependent variables – attributes and their respective levels. Nevertheless, this method lacks oevidence that it is exempt of selection bias. Those authors also list other potentially serious issues of personalysed effects from ACM. For example, one version may have more high (low) prices levels than others, which might influence: the alternative specific constants; different prices sensitivity; higher choice variability within and between subjects (error variance), leading to parameters differences due to scale difference. In this case, the differences of scale of each Individual Utility Function (IUF) will misinterpretate differences among individuals, which can lead to incorrect conclusions of explanatory variables effects.

Indirect estimation models, such as Hierarchical Bayes (HB), estimates the mean and covariance of individual parameters distribution. The model is called Hierarchical because there are two levels in the estimations. At the higher levels, it is assumed that individual parameters (betas or part worth) are described by a multivariate normal distribution. At this level, the betas of each respondent are considered as crude estimates and they are used as a starting point. At lower level, it assumed that, given the crude betas, the probability of achiving an outcome (for example, choosing a product) is determined by a particular model, such as multinomial logit or linear regression.

In the second step, an interactive process, called "Gibbs Sampling", is carried out. It calculates one parameter in each interaction and the process is conditioned on current estimations of others parameters. It is assumed that respondents' betas conform to a normal distribution. According to Orme (2000), the HB algorithm generates betas that fit each individual response reasonable well, but "borrows" information from other respondents to stabilize the estimations. However, Louviere *et al.* (2009) mention that if assumptions about preferences distributions in HB are wrong, estimations will be biased and incorrect.

Random Effect models are also used to estimate individual utility functions, but they make several assumptions about unobserved preference heterogeneity of the population. For example, the Latent Class model considers that preferences are normally distributed within each Latent Segment and Mixed logit model are estimated based on assumptions about unknown preferences' distributions and it also takes into account that preference distributions are continuous. If these preferences distribution are broken, neither Latent Class nor Mixed logit will produce unbiased parameters (Louviere *et al.*, 2009).

Islam (2008) compared the Bottom-up model performance with the Mixed logit and Hierarchical Bayes models. He found that the Bottom-up model provides a superior consistency in-sample (measured by R^2 within sample) as well as out-of-sample fits (he estimated the predictability choices errors in sample 2 based on data from sample 1 and vice-versa).

The Bottom-up model estimates directly the dependent variables' betas, for each respondent. As estimations are independent, therefore the basic condition of normal distributions of preferences (betas) is not necessary. Assuming normally distributed preferences for each person is not sucha a strict assumption as if applied to all sampled people (Louviere *et al.*, 2009).

5.C.2) How the Bottom-up model allows individual utility estimation

According to Louviere *et al.* (2009), the Bottom-up model considers that consumers chose all alternatives of the choice sets. Considering the last example of preference (A > B > C), the model takes into account the probability of selecting the alternative A as the best option among the available alternatives A, B and C; the probability of chosing alternative B as the second best alternative among the available alternatives A, B and C and the probability of selecting alternative C as the worst alternative among the available alternatives A, B and C. In comparison to TDCE it increases the number of observations by the number of alternatives, in this case by 3 times. The number of observations improves 50% in this example with the simultaneous BWDCE.

For best alternatives choices, McFadden (1974) proved that Equation 5.5 can be transformed into a Multinomial Logit Model (MNL) to Equation 5.11. The log likelihood function (equation 5.11) is maximized using a non-linear algorithm calculating βs (Equation 5.2), which are the marginal utility of each attribute-level (Louviere *et al.*, 2000). In the TDCE, f_{iq} takes value 1 when the alternative *i* (the best alternative – in the example is the alternative A) is chosen by subject *q* and 0 otherwise.

$$L^* = \sum_{q=1}^{Q} \sum_{j=1}^{J} f_{jq} \ln P_{jq} \qquad 5.11$$

In the case of the Bottom-up model, f_{jq} is always 1, i.e., the subject selects all alternatives in the choice set. However, each alternative in the choice set has a different weight (w_{jq}) and it varies according to its rank in the choice set (Equation 5.12). This model does not consider the non buying alternative, hence the "Buttom-up" models is a weighed conditional logit approach.

$$L^* = \sum_{q=1}^{Q} \sum_{j=1}^{J} f_{jq} w_{jq} \ln P_{jq} \qquad 5.12$$

Louviere and Woodworth (1983) show that it is possible to calculate parameters in aggregate multinomial logistic models based on Weighted Least Square (WLS) regressions. The Bottom-up model yields the same parameters if estimated by WLS as well as MNL. Weighting each observation according to the alternatives' rank is based on the expected choices counts.

The expected choices counts can be calculated from all possible combination of alternatives, considering if it is present or absent in each combination. Thus, the expected choice counts (weights) vary according to the total number of alternatives in the choice set. For example, if there were J alternatives (in our case, each alternative is a hypothetical peach), it was possible to make 2^J different combinations. Taking into consideration that the rank order of those alternatives was known and it varies according to the respondent's preferences, the most preferable alternative would be selected $2^J/2$ times as the best alternative, the second most preferable alternative is chosen $2^J/4$ times as the best alternative, the third is chosen $2^J/8$ times as best alternative. Thus, if there were 3 alternatives (A > B > C) in a choice set, the weights (the expected choice counts) of alternatives would be: for the best option (alternative A), also ranked 1st, it is equal to 4 ($2^3/2$), for the second best option (alternative B), also ranked 2nd, the weight is 2 ($2^3/4$) and for the worst option (alternative C), also ranked in the 3rd position, it is 1 ($2^3/8$).

Louviere *et al.* (2009) affirm that these weights can be viewed as two ways: a) as marginal choice frequencies associated with each choice option defined by each combination of alternatives; b) as information needed to decompose the choices into a generic indirect utility function provided by main effects.

The Bottom-up model takes care of the choices taken by individual decision-maker combining statistically efficient experimental design, such as those developed by Street and Burgess (2007), and a full ranking of alternatives by using the most and the least preferred option. An optimal experimental design, with D-efficiency of 100%, provides the best combination of factors, here attributes-levels, which give more accurate parameter estimates from the same number of observation, in other words, it minimizes the demand of choice observations to estimate models individual.

Theoretically, any DCE can be used to estimate individual utility functions, they yield parameters with different accuracy even they have the same number of variables, choice sets, alternatives in each choice set and experimental design efficiency. Most empirical studies adopt p-value of 1%, 5% and 10%. When the null hypothesis of non effect is refused at p-value of 10%, it is assumed that the parameter is different from zero at 90% of probability. Often 90% of probability is the lowest acceptable in empirical studies. Nevertheless, to obtain accurate betas (with p-value, at least, of 10%) from DCE will demand a prohibitive number of observations per person.

Louviere *et al.* (2009), when they propose the Bottom-up model, they illustrate an empirical case of preferences from 12 students with 12 IUFs. Their experimental design has three 2-level attributes and three 4-level attributes, and student rank alternatives only of 16 choice sets, each choice set with 4 alternatives. In total they estimate 144 betas (12 betas per student x 12 students) and 40 of them (27.77%) were statistically different from zero at 1% of p-value; 9 (6.25%) betas were significantly different from zero at 5% of p-value; and 8 (5.55%) betas were different from zero at 10% of probability.

5.2.2.1 Experimental design

Four peaches' attributes were selected based on, the literature review about fruit quality and market tendencies, a focus group, some interviews with fruit and vegetable section managers of three retails distribution chains in Zaragoza and local market monitoring. Those attributes were peaches origin, type of packing, peach size and price. Three levels were also considered for each attribute. They are listed on table 5.1.

Table 5.1 Attributes and levels employed in the experiment

Attribute	Level	Attribute	Level
Origin	From Calanda with PDO	Size	Smallest
	From Calanda without PDO[1]		Medium[1]
	Other places without PDO		Largest
Packing	Active packing	Price	1.5€/kg
	No active packing[1]		2.5€/kg[1]
	Bulk		3.5€/kg

[1] reference levels to estimate effect codes

Price is included in the experiment as it allows estimating Willingness to Pay (WTP) calculations for other attributes. Price was considered as a quantitative (numeric) variable for estimation purposes and the remaining attributes were considered as categorical (qualitative) variables. The qualitative variables have been estimated by code effects. Louviere *et al*. (2000) stated that codes effects are correlated in each attribute but are uncorrelated with the overall mean, unlike dummies. The effect codes should be interpreted as the difference utility in relation to a reference level.

The reference level for the origin is peaches "from Calanda without PDO". The difference of WTP between peaches "from Calanda with PDO" and "from Calanda without PDO" would be the generic PDO brand value. It means how much money consumers value the guarantee of peaches with controlled quality linked to the PDO brand. The difference between WTP of peaches "from Calanda without PDO" and those "produced in other places" assesses how much consumers value the production of peaches coming from Calanda, but without the guarantees associated to the PDO brand.

The expected sign of theses parameters are positive for PDO peaches and negative for peaches produced in other places.

The experiment includes two different types of packing, one normal and other active. Respondents were informed that active packing does not imply negative health effects and it allows keeping stocks 12 days more than with not active packing. The active packing parameter sign may be positive for some consumers who wish to store peaches longer time. The negative sign would be expected for those consumers who, either believe that the active packing treatment has negative consequences for their health or they can also refuse packed peaches showing certain kind of neophobia.

Different peaches' sizes were shown to respondents in the experiment. The weight of a small peach was about 160g, a medium size was around 250g and a big one was around 380g. The first weight corresponds to a peach that would be refused by the PDO norms. The second is the minimum peach size accepted by the PDO norms and the largest represents a size that nobody would be able to eat at once. Normally, bigger peaches are related to higher quality, moreover there was a market segment that valued positively larger peaches up to the moment of satiating their eating capacity. Thus, the expected situation is that people have greater WTP for a medium size peach than a small one but they are not determined to select either a medium or a big size.

The configuration of the experiment corresponds to a fractional factorial design. The fractional factorial design decreases the number of combinations of a full factorial design with $\left(L^{K}\right)$ to $\left(L^{K-N}\right)$ combinations, which diminish the task complexity. Nine choice sets allow main estimations effects of the attributes` levels of a no label design, with 4 attributes and 3 levels in each one. According to Montgomery (2001) and Louviere *et al.* (2000) main effects explain 70 to 90% of the total variance, while two ways interaction effects only explain 5 to 15%. The estimation of two ways interaction effects would need a great number of choice sets and no references were found about analyzing this type of best-worst experiments in blockings. It was esteemed that only main effects would provide enough information.

No biased estimators are obtained if expected parameters converge to real values and efficient parameters as those that have the minimum variance. To get non biased and efficient parameters, attribute's levels were combined, following suggestions of Street *et al*. (2005). Their strategies to construct a statically efficient experiment design are based on modular mathematic, which first selects profiles from a full factorial design and then there is a generation of choice sets` options based on the first selected profiles.

Those strategies generated a balanced and orthogonal design. A design is balanced when each level of each attribute appears, in each choice set, only once. Thus, each level has the same probability to be chosen. A design is orthogonal when there is no correlation among attributes' levels. Its D-efficiency index was checked on the internet home page suggested by Pihlens *et al*. (2008), and the estimated value is 100%, so the estimated parameters are efficient and not biased.

Respondents were asked to choose the best and the worst hypothetical peaches among three alternatives in a choice set or buying situation. It allows having complete ranking alternatives in each choice set. Table 5.2 provides an example of a choice set. In this case, the most preferable peach would be alternative A, followed by alternatives C and B. This table also shows that this choice set is an open end task because, after selection of the most preferable (the best) and the least preferable (the worst) options, respondents states if they would like to buy the best alternative. Open end tasks are used to keep the most of the information of the best profile.

Table 5.2 Example of a choice set in the experiment

Least preferable	**Situation 4**	**Most preferable**
	Alternative A	X
	2.50 €/kg	
	From Calanda area **with** PDO	
	Bulk	
	Medium	
X	**Alternative B**	
	3.50 €/kg	
	From other area **without** PDO	
	Normal packing	
	Largest	
	Alternative C	
	1.50 €/kg	
	From Calanda area **without** PDO	
	Active packing	
	Smallest	
If I could, I would not choose any of the previous (X)		

The questionnaire was applied to consumers attending two hypermarkets, in the city of Zaragoza (Spain), at the end of October 2008, when the PDO Calanda peaches marketing season was finishing. Respondents spent more or less 25 minutes answering the questionnaire and they were offered, as a gift, one kilogram of PDO Calanda peaches.

5.2.2.2 Empirical models

A limitation of the Bottom-up model is that it is applicable just for generic experiments design (generic choice experiment is further discussed in Louviere *et al.* (2000)) and only main effect estimations. Thus, taking into account these issues and the considered attributes-levels (variables), the consumers' preferences habe been trated with two additive models (derived from Equation 5.2) to calculate the marginal utility of alternatives late season peaches (Equation 5.13 and 5.15).

$$\begin{aligned} V_i = {} & \beta_{i1} price + \beta_{i3} origin_1 + \beta_{i4} origin_2 + \beta_{i5} packing_1 + \\ & + \beta_{i6} packing_2 + \beta_{i7} size_1 + \beta_{i8} size_2 \end{aligned} \qquad 5.13$$

Where:

Price = price is a numeric variable. Thus, when alternative is chosen as the best option of the choice set, then if the price of the alternative is 1.5€/kg, it is 1.5; if the price of the alternative is 2.5€/kg, it is 2.5; and if the price of the alternative is 3.5€/kg, it is 3.5. When an alternative is chosen as the worst option of the choice set, then if the price of the alternative is 1.5€/kg, it is -1.5; if the price of the alternative is 2.5€/kg, it is -2.5; and if the price of the alternative is 3.5€/kg, it is -3.5.

$Origin_1$ = when an alternative is chosen as the best option of the choice set, then if the origin-level of the alternative is "from Calanda area with PDO", it is 1; if the origin-level of the alternative is "from Calanda area without PDO", it is -1; and if the origin-level of the alternative is "from other area without PDO", it is 0. When an alternative is chosen as the worst option of the choice set, then if the origin-level of the alternative is "from Calanda area with PDO", it is -1; if the origin-level of the alternative is "from Calanda area without PDO", it is 1; and if the origin-level of the alternative is "from other area without PDO", it is 0.

$Origin_2$ = when an alternative is chosen as the best option in the choice set, then if the origin-level of the alternative is "from other area without PDO", it is 1; if the origin-level of the alternative is "from Calanda area without PDO", it is -1; and if the origin-level of the alternative is "from Calanda area with PDO", it is 0. When an alternative is chosen as the worst option of the choice set, then if the origin-level of the alternative is "from other area without PDO", it is -1; if the origin-level of the alternative is "from Calanda area without PDO", it is 1; and if the origin-level of the alternative is "from Calanda area with PDO", it is 0.

$Packing_1$ = when an alternative is chosen as the best option of the choice set, then if the packing-level of the alternative is "bulk", it is 1; if the packing-level of the alternative is "normal packing", it is -1; and if the packing-level of the alternative is "active packing", it is 0. When an alternative is chosen as the worst option of the choice set, then if the packing-level of the alternative is "bulk", it is -1; if the packing-level of the alternative is "normal packing", it is 1; and if the packing-level of the alternative is "active packing", it is 0.

$Packing_2$ = when an alternative is chosen as the best option of the choice set, then if the packing-level of the alternative is "active packing", it is 1; if the packing-level of the alternative is "normal packing", it is -1; and if the packing-level of the alternative is "bulk", it is 0. When an alternative is chosen as the worst option of the choice set, then if the packing-level of the alternative is "active packing", it is -1; if the packing-level of the alternative is "normal packing", it is 1; and if the packing-level of the alternative is "bulk", it is 0.

$Size_1$ = when an alternative is chosen as the best option of the choice set, then if the size-level of the alternative is "smallest", it is 1; if the size-level of the alternative is "medium", it is -1; and if the size-level of the alternative is “largest packing”, it is 0. When an alternative is chosen as the worst option of the choice set, then if the size-level of the alternative is “smallest”, it is -1; if the size-level of the alternative is “medium packing”, it is 1; and if the size-level of the alternative is “largest packing”, it is 0.

$Size_2$ = when an alternative is chosen as the best option of the choice set, then if the size-level of the alternative is “largest”, it is 1; if the size-level of the alternative is “medium”, it is -1; and if the size-level of the alternative is “smallest”, it is 0. When an alternative is chosen as the worst option of the choice set, then if the size-level of the alternative is “largest”, it is -1; if the size-level of the alternative is “medium”, it is 1; and if the size-level of the alternative is “smallest”, it is 0.

Equation 5.13 estimates the average utility (V_i) that all sampled consumers have with the option *i*. This analysis was carried out at sample level, i.e., it was calculated one function for all sampled consumers. Price was considered as a numeric variable, thus the model could estimate consumers’ willingness-to-pay for different characteristics of late season peaches. This analysis level was divided in two parts, the first considering homogeneity on consumers’ preferences and the second taking into account the heterogeneity. In order to study heterogeneity, it was estimated a new empirical model, represented by Equation 5.14, with new parameters added (α_{ik}) to measure the interactions effects between late season peaches’ characteristics (X_{ik} is the vector of late season peach’s attribute-levels of the alternative *i*) and consumers’ profiles (Z represents the vector of consumers’ profile n), where α and β are vectors parameters to be estimated.

$$V_{in} = \sum_{k=1}^{K} \beta_{ik} X_{ik} + \sum_{k=1}^{K} \alpha_{ikn} X_{ik} Z_{in} \qquad 5.14$$

The interaction effect was calculated separately for six kind of consumers’ characteristics (n = 1, 2,…,6). The empirical model deals with different consumers’ consumption frequencies of PDO Calanda peaches (Z takes value 1 for regular consumers and 0 for sporadic consumers); loyalty degree toward PDO Calanda peaches (Z take value 1 if consumers had high loyalty degree – would buy a no stone fruit if PDO Calanda peaches were available in the market - and 0 otherwise); gender (Z takes value 1 if consumer is female and 0 if consumer is male); education level (Z takes value 1 if consumer has elementary education level and 0 otherwise); age (Z takes value 1 if consumer who is 50 or older and 0 if he is younger); and household income (Z takes value 1 households with income less than 1,500€/month and 0 otherwise).

5.3 Preferences for late season peaches market in Zaragoza city

5.3.1 Late season peaches' market

In this part of the study, the consumers' average preferences for late season peaches, in the city Zaragoza, are calculated. The objectives of the first part of this section are to check the consistency of results from the Best-Worst Discrete Choice Experiment coding system, evaluating the model fitting of conditional and unconditional choice models; how the number of observations and number of alternatives change the model fitting; and to compare the Bottom-up model performance with other approaches.

Table 5.3 shows results, for each attribute-level, of utilities provided by late season peaches in Zaragoza, in 2008. These utilities were estimated considering the information of the best alternatives in each choice set and it is why those models are called Traditional Discrete Choice Experiments. The difference between the model 1 (unconditioned) and the model 2 (conditioned) is that model 1 incorporates the no buying option, while model 2 forces respondents to buy some hypothetical peaches. The no buying effect is measured by the constant term of model 1.

In both models, the number of observations are de same (316 consumers * 9 choices per consumer = 2,844 observations). Model 1 explains better the consumers' response variance (Adjusted R^2 = 0.37) than model 2 (Adjusted R^2 = 0.27). The estimated parameters from models 1 and 2 have similar values and accuracy (measured by p-value). Model 2 has smaller final log likelihood, which helps to decrease its Constant Akaike Information Criteria (CAIC). The CAIC was estimated according to Sawtooth (2007): CAIC = k * [ln (N) + 1] - 2 * ln (L), where k is the number of parameters; N is the number of observations and L is the maximized value of the likelihood function for the estimated model. In relation to these two approaches, the better fitted model is that one with smallest CAIC, which in this cases is the model 2.

Table 5.3 Estimated parameters[1] by Traditional Discrete Choice Experiment (TDCE) with conditional and unconditional method

Parameters	Model 1 (Unconditional)	Model 2 (Conditional)
Constant	-3.18 (-20.46)***	-
Price	-0.28 (-9.00)***	-0.28 (-8.86)***
From Calanda area with PDO	1.03 (33.59)***	1.03 (33.88)***
From Calanda area without PDO[2]	-0.03	-0.03
From other area without PDO	-1.00 (-21.94)***	-1.00 (-22.17)***
Bulk peaches	0.05 (1.55)^{ns}	0.04 (1.25)^{ns}
Normal packing[2]	0.16	0.17
Active packing	-0.21 (-6.61)***	-0.21 (-6.48)***
Smallest size	-0.28 (-8.24)***	-0.28 (-8.24)***
Medium size[2]	0.15	0.14
Largest size	0.13 (4.14)***	0.13 (4.36)***
Number of estimated parameters	8	7
Number of observations	2,844	2,844
Final log-likelihood	-2,491.81	-2,269.95
Adjusted rho-square	0.37	0.27
CAIC	5,055.24	4,602.57

Note: (^{1}) p-test values are in the bracket. The symbol (***) represents parameter statistically significant at 1%, (**) at 5%, (*) at10% and (^{ns}) it is not statistically significant; (^{2}) the attribute-level of reference.

Table 5.4 presents the estimated parameters considering the full ordering of alternatives in the choice sets. Model 3 was calculated from the exploded process; model 4 estimates a sequential BWDCE; model 5 is the simultaneous BWDCE without scale factor; and model 6 is also a simultaneous BWDCE, but it incorporates a scale factor. The scale factor was calculated considering that the best alternative choices belonged to one survey and that the worst alternative choices belonged to another survey, but they present the same preferences. This estimation process is employed in data pooling from stated and revealed preference surveys.

Model 6 was introduced in the analysis because different variances were found between the most and the least important options statements of attributes in Chapter 4. Analytically, it is assumed that choice processes error terms of the most and the least important chosen alternatives are IID extreme value type 1 (EV1) which are associated, respectively, with scale factor λ^b and λ^w. An important property in the MNL model is that the scale factor is inversely related $\left(\sigma^2 = \pi^2 / 6\lambda^2\right)$ to the error term variance (Louviere *et al.*, 2000). Thus, higher scale factors are achieved from better fitted models, which present smaller variance in their parameters.

It is not possible to spot a scale factor within a particular data source because the expression $\left(\beta_k \lambda^b\right) = \left(\beta_k \lambda^w\right)$ can not be solved. However, when there are more than one data source it is possible to estimate a relative scale factor by normalising one scale, in this case $\left(\lambda^w \equiv 1\right)$. Consequently, the estimated log likelihood function is $\psi\left(\beta, \lambda^b\right)$, which depends of the vector jointly parameters (the restriction is that parameters are equal) and the relative scale factor $\left(\lambda^b\right)$ of the most important alternatives.

The relative scale factor of the best alternatives is 1.21 and it is statistically significant at 1%. Its value is higher than the normalized scale factor $\left(\lambda^w \equiv 1\right)$ because the variance of the best alternatives is 46.41% smaller[12] than the variance of the least important alternatives choices.

The least approach (Model 7) deals with the Bottom-up model. The performance of this model was never tested at sample level. At sample level, the Bottom-up model only increases the number of observations and the assumptions about preference distributions across respondents should be adopted.

The number of observations improves from 2,844 (316 consumers x 9 choices per consumer (9 = 1 choice per choice set * 9 choice sets per consumer)) in Traditional Discrete Choice Experiment to 5,688 (316 consumers * 18 choices per consumer (18 = 9 choice sets per consumers * 2 statements per choice set)) in models 3, 4, 5 and 6 and this number arrives to 8,532 (316 consumers * 27 choices per consumer (27 = 9 choice sets per consumers * 3 statements per choice set)) in the Bottom-up model.

[12] The ratio between the variances of the most and the least important alternatives choices, is calculated as follows: $\frac{\sigma_b^2}{\sigma_w^2} = \frac{\pi / 6\lambda_b^2}{\pi / 6\lambda_w^2} = \left(\frac{\lambda_b}{\lambda_w}\right)^2 \approx \left(\frac{\hat{\lambda}_b}{\hat{\lambda}_w}\right)^2 = \left(\frac{1.21}{1}\right)^2 = 1.4641$ and the difference is (1-1.4641) = -0.4641 or -46.41%.

Table 5.4 Estimated parameters[1] by the Exploded and Sequential and Simultaneous Best-Worst (BW) models without and with scale factors

Variables	Model 3 Exploded	Model 4 Sequential BW	Model 5 Simultaneous BW without scale factor	Model 6 Simultaneous BW, with scale factor	Model 7 Bottom – up
Price	- 0.29 (-14.38)***	- 0.29 (-14.38)***	- 0.31 (-15.95)***	- 0.27 (-13.35)***	- 0.09 (-6.79)***
From Calanda area with PDO	0.84 (34.10)***	0.84 (34.10)***	0.95 (40.36)***	0.84 (24.27)***	0.35 (23.97)***
From Calanda area without PDO[2]	- 0.09	- 0.09	- 0.08	- 0.04	- 0.02
From other area without PDO	- 0.75 (-31.94)***	- 0.75 (-31.94)***	- 0.87 (-38.85)***	- 0.80 (-28.90)***	- 0.34 (-19.43)***
Bulk peaches	- 0.02 (-0.89)^{ns}	- 0.02 (-0.89)^{ns}	- 0.03 (-1.58)^{ns}	- 0.02 (-0.81)^{ns}	- 0.00 (-0.09)^{ns}
Normal packing[2]	0.17	0.17	0.18	0.15	0.05
Active packing	- 0.15 (-6.97)***	- 0.15 (-6.97)***	- 0.15 (-7.13)***	- 0.13 (-6.51)***	- 0.05 (-2.95)***
Small size	- 0.23 (-9.97)***	- 0.23 (-9.97)***	- 0.25 (-11.35)***	- 0.23 (-11.06)***	- 0.09 (-5.40)***
Medium size[2]	0.13	0.13	0.14	0.13	0.05
Largest size	0.10 (4.41)***	0.10 (4.41)***	0.11 (5.25)***	0.10 (5.32)***	0.04 (2.63)***
Relative scale factor[3]	-	-	-	1.21 (3.38)***	-
Number of estimated parameters	7	7	7	8	7
Number of observations	5,688	5,688	5,688	5,688	8,532
Final log-likelihood	-4,174.43	-4,174.43	-4,846.74	-4,839.82	-20,984.73
Adjusted rho-square	0.18	0.18	0.22	0.22	0.04
CAIC	8,416.39	8,416.39	9,761.01	9,756.82	42,039.82

Note: ([1]) t-test values are in the bracket. The symbol (***) represents parameter statistically significant at 1%, (**) at 5%, (*) at10% and (^{ns}) it is not statistically significant; ([2]) the attribute-level of reference. ([3]) The relative scale factor from the statements of the worst options is 1.

Although there is not formal demonstration about the Best-Worst coding system, there is strong evidence that this coding system yields consistent results. Results from model 3 and 4 are the same.

Simultaneous Best-worst models, represented by model 5 and 6, increment the number of alternatives in each choice situation, and as a consequence, their fitting (measured by CAIC) decreases in relation to sequential models (models 3 and 4). It happens because the probability of selecting a determined alternative among three available alternatives is lower than selecting it between two alternatives. The outcome is that the final log-likelihood decreases as well as the CAIC.

However, increasing the number of alternatives increases the explanatory power of consumers' responses variances. The simultaneous BW models' adjusted R^2 is 0.22 while for sequential BW or ranking model R^2 is 0.18. Another simultaneous BW models' desired consequence is the increasing of estimated parameters accuracy. For example, all t-values of model 5 have higher (more accuracy) than t-values from sequential models.

Taking into account the different variance of stating the best and the worst alternatives, it provides better fitting models. In this case, model 6 produces higher final log-likelihood and lower CAIC than model 5, which considers that best and worst statements have the same variance. However, adding the relative scale factor, it decreases the variable accuracy. Only the t-value of largest size peach from model 6 has higher accuracy than the same parameter from models 5. For other variables, model 5 generated always parameters with higher values than model 6.

Model 7, or Bottom-up model, is the model with the highest number of observations. It has the smallest R^2 (0.04) and log-likelihood and the highest CAIC. It means that it has worst results than other estimated models. In the case of simultaneous BW, the decrease of model fitting is compensated by the increase of parameters accuracy. In the case of the Bottom-up model it does not happen, as its estimated parameters have the lowest accuracy. Thus, this model is the least indicated to study consumers' preferences at sample level.

Although considered models have different performance and generate parameters with different t-values, all of them have parameters with the same sign. Both models consider that the entire market has same preferences, i.e., the estimated parameters in Table 5.4 represent the average preference for late season peaches in Zaragoza city. In this city, for example, price of peaches gives negative utility to consumers. This result is as expected because, if subject behave rationally, he will prefer to pay less money for a determined product.

In relation to origins' levels, consumers think that peaches produced in the Calanda area without Protected Designation of Origin (this is the attribute-level of reference) are different to those also produced in the Calanda area but with PDO, because the estimated parameters are different from zero at least with 99% of probability. In this case, the utility of PDO brand is measured. Results demonstrate that consumers prefer peaches with PDO brand than without PDO brand.

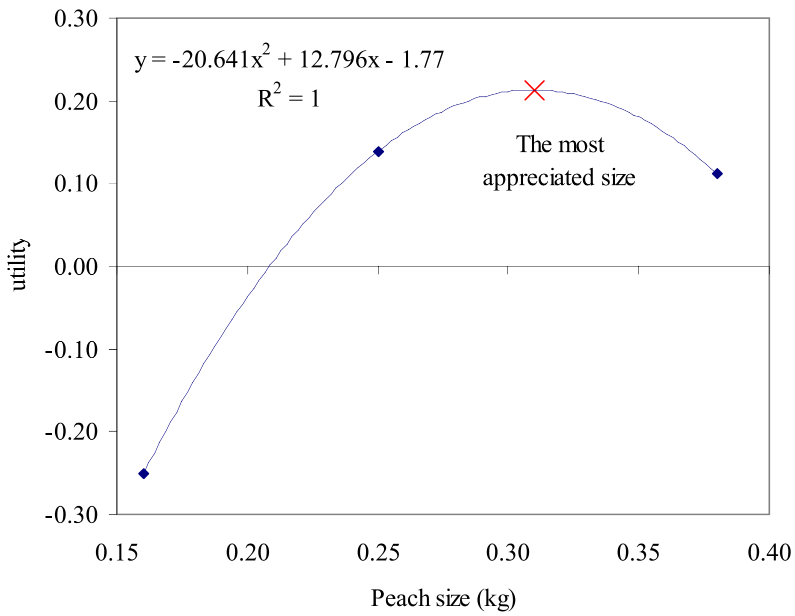
The calculated parameters from other area without PDO are marginal utilities of changing peaches produced in Calanda area without PDO with peaches produced in other areas without PDO. As both attribute-levels represent peaches without PDO, the utility is only related to the production area (at or not at Calanda area). Thus, the negative parameters say that, to maintain consumers' utilities, they should be compensated (for example, with lower price) when they change peaches produced in the Calanda area for peaches produced in other areas, otherwise their utility will decrease.

An additional statement that all models allow to make is that, consumers are more sensitive to PDO Calanda peaches brand than the production area. This conclusion can be assumed because the estimated parameters from Calanda area with PDO are higher than from other area without PDO.

Regarding packing levels, bulk peaches' parameters are not statistically different from zero. Accepting the null hypothesis (H_0: $\beta = 0$), that consumers do not distinguish between bulk peaches and peaches conditioned in normal packing. On average, consumers are indifferent between these two characteristics. Nevertheless, the parameters of active packing are negative and statistically different from zero. It points out that consumers distinguished between these two levels of the attribute and they preferred the normal to active packing. Thus, the benefit of storing peaches for longer time in this kind of packing is valued by consumers as something not desired whereas they think that peaches in bulk are similar to packing without treatments.

Peach size was taken in to account by consumers too. Preferences for smallest and largest peaches are statistically different, at 99% of probability, from the medium size peaches. Explanatory variables were described using code effect. Thus, the coefficient of the base level, medium size, is the negative sum of the coefficients of other levels from the same attribute (smallest and largest size). Graphic 5.1 plots the relationship between estimated utilities and weights (160g for smallest, 250g for medium and 380g for largest) from the three peaches sizes of model 5 (Table 5.4). To describe the consumers' preferences as a whole, the estimated parameters of model 5 are considered. Although model 5 does not have the best CAIC, it explains well response variances (R^2 of 0.22) and it provides parameters with highest accuracy than other models.

Graphic 5.1 Relationship between late season peach size and estimated utility



It was carried out a regression between estimated utilities and peaches sizes in order to determine the most appreciated late season peach size. Considering size levels as numeric and continuous variables, it was found that a quadratic function provides a regression with the highest coefficient of determination ($R^2 = 1$). Based on the estimated regression ($y = -20.641x^2 + 12.796x – 1.77$, where "y" is the utility and "x" the peach weight, in kilograms), consumers have positive utility with peaches weights more than

208g and less than 412g. The most appreciated size of late season peaches in Zaragoza city is around 310g (Graphic 5.1).

5.3.2 Different peach markets

Five models were estimated in order to value how consumers, with different profiles, perceive late season peaches quality. Each model calculates the interaction between each peach attribute-level and each consumer's characteristic. For example, Model 8 estimates if there is connection between PDO Calanda peaches consumption frequency and consumers' quality perception. Model 9 considers the consumers' loyalty degree toward PDO Calanda peaches. Model 10 takes into account consumers' gender, Model 11 education level, Model 12 consumers' age and Model 13 household income (Table 5.5).

Model 8 states that regular consumers, besides having less disutility with price, are different from sporadic consumers by their quality perception about active packing. They have smaller disutility with active packing. Regarding levels of different origins, peaches sizes, peaches sold conditioned in normal packing or in bulk, regular consumers have the same utility than sporadic because the interaction with those parameters are not statistically different from zero.

Loyalty degree explains the different perceptions concerning price, PDO brand and bulk peaches. Consumers with the highest loyalty degree, those who correspond to those who would not buy a stone fruit if PDO Calanda peaches would not be available in the market, have smaller disutility with prices than consumers with other loyalty degree (it includes medium and low loyalty degree and represents, respectively, those consumers who would buy another stone fruit and another peaches if PDO Calanda peaches would be available in the market). Consumers with the highest loyalty degree have positive interaction with the attribute-level bulk peaches and negative interaction with peaches from Calanda area with PDO. In other words, it means that consumers with highest loyalty degree have stronger preferences for bulk peaches and less preference for PDO Calanda peaches brand than those consumers without medium or low loyalty degree.

Table 5.5 Interaction effects between late season peaches' characteristics and consumers' characteristics, estimated with the Simultaneous BW Model

Variable	Model 8 FREQUENCY	Model 9 LOYALTY	Model 10 GENDER	Model 11 EDUCATION	Model 12 AGE	Model 13 INCOME
Price	- 0.45***	- 0.40***	- 0.42***	- 0.34***	- 0.38***	- 0.34***
From Calanda area with PDO	0.92***	1.03***	0.98***	0.94***	0.91***	0.94***
From Calanda area without PDO^{1}	- 0.01	- 0.13	- 0.06	- 0.04	- 0.03	0.00
From other area without PDO	- 0.90***	- 0.90***	- 0.93***	- 0.90***	- 0.88***	- 0.94***
Bulk peaches	- 0.04^{ns}	- 0.12***	- 0.09***	- 0.05*	- 0.06**	- 0.01^{ns}
Normal packing^{1}	0.25	0.26	0.23	0.18	0.2	0.18
Active packing	- 0.21***	- 0.14***	- 0.14***	- 0.13***	- 0.14***	- 0.17***
Small size	- 0.24***	- 0.29***	- 0.29***	- 0.26***	- 0.27***	- 0.27***
Medium size^{1}	0.14	0.16	0.12	0.14	0.12	0.15
Largest size	0.10***	0.13***	0.17***	0.12***	0.15***	0.12***
Characteristic x price	0.21***	0.12***	0.18***	0.12***	0.17***	0.09**
Characteristic x from Calanda area with PDO	0.06^{ns}	- 0.11**	- 0.05^{ns}	0.04^{ns}	0.11**	0.03^{ns}
Characteristic x from other area without PDO	0.05^{ns}	0.04^{ns}	0.09**	0.10**	0.02^{ns}	0.19***
Characteristic x bulk	0.01^{ns}	0.12***	0.09**	0.04^{ns}	0.06^{ns}	- 0.06^{ns}
Characteristic x active packing	0.09**	- 0.02^{ns}	- 0.02^{ns}	- 0.07^{ns}	- 0.03^{ns}	0.06^{ns}
Characteristic x small size	- 0.02^{ns}	0.05^{ns}	0.06^{ns}	0.02^{ns}	0.06^{ns}	0.05^{ns}
Characteristic x largest size	0.02^{ns}	- 0.02^{ns}	- 0.09**	- 0.01^{ns}	- 0.10**	- 0.02^{ns}
Number of estimated parameters:	14	14	14	14	14	14
Number of observations:	5,688	5,688	5,688	5,688	5,688	5,688
Final log-likelihood:	-4,825.99	-4,838.21	-4,831.71	-4,835.88	-4,826.29	-4,827.5
Adjusted rho-square:	0.22	0.22	0.22	0.22	0.22	0.22
CAIC	9,787.03	9,811.46	9,798.47	9,806.8	9,787.63	9,790.07

Note: The symbol (^{ns}) represents parameter not statistically significant, while (***) it is significant at 1%, (**) at 5%, (*) at 10%. (^{1}) the attribute-level of reference.

Model 10 states that different gender has different quality perception toward late season peaches. Women have less disutility with prices than men as well as with peaches from other areas coming not from Calanda and with bulk peaches. Men have more utility with largest peaches than women. Probably, as men have higher body indexes and need to eat more quantity of food to be satisfied, it increases their preferences for largest size peaches.

Education level has influence on the quality perceptions. Consumers with elementary education level are less sensitive to prices than those with high school or college (Model 11 from Table 5.5). This kind of consumer has less disutility with respect to peaches produced in other areas.

Regarding consumer age, it is found that consumers older than 50 years old have less disutility than those younger than 50 years old with respect to price. Older consumers have also higher preference for PDO Calanda peaches brand and smaller preference for largest size peaches.

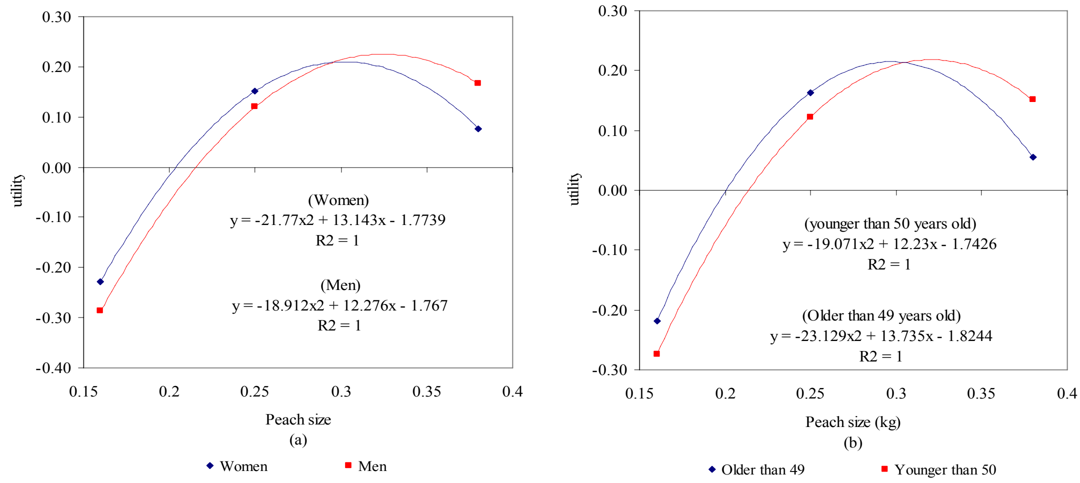
Surprisingly, the estimated interaction between household income and price is positive. It says that consumers with household income below 1,500 Euros per month are less sensitive to late season peaches prices than those with higher monthly income. This type of consumer has also less disutility with peaches from other areas that those not coming from Calanda area.

As Table 5.5 shows that only different gender and ages have statistically different utility for largest peach size, utilities provided by different peaches sizes for different gender (Graphic 5.2.a) and ages (Graphic 5.2.b) were calculated. For example, it was considered the following sum: 0.17 + 0 * -0.09 = 0.17 to calculate the utility of largest size peaches for men; and for women the following sum: 0.17 + 1 * -0.09 = 0.08 (these parameters were taken from the 6^{th} column of Table 5.5). Like in the Graphic 5.1, once known the utilities provided by each peach size for all gender and ages, regressions were estimated by Excel between peaches sizes and utilities. The aim was to determine the most appreciated peaches' size for each kind of consumer and the range of peach size which gives positive utility to consumers.

Thus, the most appreciated size of peaches for men is 325g/fruit while for women is 302g, a difference of 7.5%. Men's utility starts to be positive when peaches weight more than 215g and it is positive up to peaches' sizes of 434g (a range of 218g).

Women utility gets positive when weight is higher than 204g and it remains positive up to 400g (a range of 196g).

Graphic 5.2 Relationship between late season peach size and estimated utility for different gender (a) and different ages (b).



Peaches weighting around 297g have the most appreciated size for consumers who are 50 or older, and the best peaches' size for consumers younger than 50 years old is 321g (a difference of 7.8%). Older consumers have positive utility with peaches who weight more than 201g and less than 393g (a range of 192g) while the range starts from 214g and goes up to 428g (it is about 214g) for younger consumers.

5.3.2.1 Willingness to Pay for late season peaches

Results estimated above occur when one characteristic is desired over other characteristics. The estimated parameters allow knowing the most appreciated peach sizes, but their values are difficult to interpret, especially for practioners. Thus, results from Table 5.4 (model 5 for average results) and Table 5.5 (from model 8 to model 13 for each consumer group) were transformed to Marginal Willingness to Pay (MWTP) for each peach characteristic and for each group of consumer.

For this purpose, it is important to calculate the willingness to pay (receive) to move from one attribute-level with lower (higher) utility to another attribute-level with higher (lower) utility. This amount of money is the quantity that a consumer is indifferent between these two attribute-levels, *ceteris paribus*. This equivalence is represented by the Equation 5.15, for estimation purpose.

$$\beta_{Ai} + \beta_p p_{Ai} = \beta_{Aj} + \beta_p p_{Aj} \text{ with } p_{Ai} = p_{Aj} + x \qquad 5.15$$

Where, β_{Ai} is the estimated parameter of level *i* from attribute A, β_{Aj} is the estimated parameter of level *j* also from attribute A, β_p is the consumer's price sensitivity and p_{Ai} is the price level associated to level *i* and p_{Aj} is the price level associated to level *j*. Equation 5.15 can be modified to Equation 5.16, where x represents the consumer's willingness to pay (if $x > 0$) or to receive (if $x < 0$) when changing from attribute-level *i* to *j* of attribute A.

$$\frac{\beta_{Ai} - \beta_{Aj}}{\beta_p} = x \qquad 5.16$$

Table 5.6 shows the results of the estimated Willingness-to-Pay (WTP) for hypothetical purchases. On average (for all market), consumers are willing-to-pay 3.32€/kg to change peaches from Calanda area without PDO to peaches from the same area but with PDO. Thus, they are value the PDO Calanda brand in 3.32€/kg. Consumers are also willing-to-pay 2.54€/kg for peaches from Calanda area instead of peaches produced in other area.

As consumers prefer peaches conditioned in packing, they are willing-to-pay up to 0.71€/kg, but if there are treatments to preserve peaches for longer time, such as active packing, they have to be compensated in -1.08€/kg to maintain their original utility.

Regarding peaches sizes, it is considered the WTP for changing products between four different sizes: smallest (160g/peach), medium (250g/peach), and most appreciated (in general it is estimated in 310g/peach, but it may vary according to consumers' profile) and largest (380g/peach). Changing smallest peaches for medium size peaches, i.e., by increasing 90g the peaches weight, consumers are willing-to-pay 1.26€/kg. Whereas changing peaches with the most appreciated size by the largest peaches size, i.e., an increase of 170g has to be compensated with 0.33€/kg.

Table 5.6 Willingness-to-Pay (WTP), in €/kg, for each consumer's group and for the market as a whole, of late season peaches' characteristics in Zaragoza city in 2008

	Frequency		Loyalty		Gender		Education level		Age (years old)		Household income		
	Regular	Sporadic	High	No high	Women	Men	Elemental	No elemental	50 or older	Younger than 50	Less than 1,500	More than 1,500	On Average
- From Calanda area without PDO to from Calanda area with PDO……..........................	4.62	2.07	3.56	2.94	4.29	2.48	5.16	2.85	5.67	2.47	4.75	2.76	3.32
- From other area without PDO to from Calanda area without PDO…………………….	3.09	1.98	2.91	1.94	3.05	2.06	2.70	2.49	3.38	2.23	2.08	2.72	2.54
- Bulk peaches to normal packing……...............	0.91	0.64	1.09	0.94	1.25	0.76	1.47	0.64	1.46	0.67	1.43	0.56	0.71
- Normal packing to active packing………	-1.39	-1.02	-2.21	-1.01	-2.52	-0.89	-2.92	-0.89	-2.97	-0.87	-1.98	-1.03	-1.08
- Smallest to medium size*…………….....	1.67	0.85	1.33	1.12	1.58	0.97	1.65	1.15	1.85	1.04	1.35	1.22	1.26
- Medium to the most appreciated size*…	0.33	0.15	0.25	0.21	0.24	0.25	0.31	0.22	0.25	0.25	0.26	0.23	0.24
- The most appreciated to the largest size*	-0.40	-0.25	-0.34	-0.29	-0.55	-0.14	-0.44	-0.30	-0.77	-0.18	-0.34	-0.32	-0.33
- The most appreciated peach size (g)…….	312	307	310	310	302	325	309	310	297	321	311	310	310

Note: (*) small size ~ 160g, medium size ~ 250g and largest size ~ 380g and the most appreciated size is determined for each group according to the last three sizes

According to the information displayed from Tables 5.3 up to Table 5.6, the best quality peach is produced in Calanda area, with PDO brand, conditioned in normal packing, and weighting 310g, while the worst quality peach is represented by one peach which was not produced in Calanda area, without PDO brand, conditioned in active packing and weighting 160g. Considering the WTP from Table 5.6, it is possible to conclude that the difference of price between the best quality peaches and the worst quality peach is 8.44€/kg.

This number is very high, especially if market monitoring information (section 2.5 – Chapter 2) is taken into account. According to Graphic 2.3 the highest price was observed in “El Corte Inglés” in October 6th and it was around 4.00€/kg. In Carrefour the average price was lower and the highest price was around 2.50€/kg. This over estimation of WTP can be attributed to the nature of the choice experiment.

Stated preference methods have a limitation, known as hypothetical bias, which affects the estimated willingness-to-pay values. According to Chengyan and Tong (2009) hypothetical bias is the difference between what people say they would pay for a good or a policy and what they would actually pay. Although this may not always reflect their true preferences regarding the good being valued, Stenman and Svedsäter (2008) argue that people seem to prefer to do what they say than what they do.

Many works report that there are overestimations of willingness-to-pay on their stated preferences responses. List and Gallet (2001), carry out a meta-analysis of 29 experimental studies of hypothetical bias, and they estimate that the ratio between hypothetical and actual willingness-to-pay is around 3 times, which is called factor is 3. Murphy *et al.* (2005) also carry out a meta-analysis and they find a ratio of 1.35 and with a severe positive skewness distribution. In both papers, the authors pointed out that publics’ goods have higher ratio than private goods. In this study, it is assumed that consumers have overestimated their WTP around 35%.

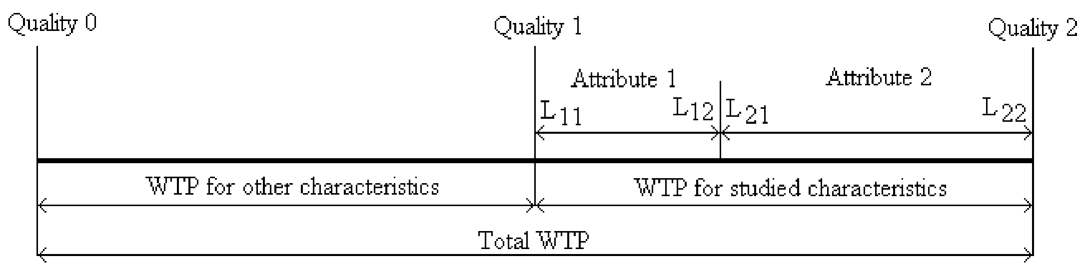
As ratio between hypothetical and real choices has high variance and it depends on the product, population, etc., a factor to approach the estimated WTP from Table 5.6 to the real market would be an arbitrary decision. Although information from part II A of survey from 2009 (Appendix 2 and 4) are also hypothetical, they are considered to weight the WTP from Table 5.6 to Table 5.8.

5.3.2.2 Adjusting the Willingness to Pay for late season peaches

Discrete Choice Experiment (DCE) allows to measure the consumers' WTP for changing one attribute-level for other level of the same attribute. Assuming that the model is additive, it is possible to determine profiles, either the best, or the product with highest quality and the worst or the product with the lowest quality, based on a set of attributes-levels. It is still possible to measure how much consumers are willing-to-pay for changing one product with lower quality for other with higher. In our case, consumers pay up to 8.44€/kg to change the lowest quality for the highest quality peaches, but this quality is only based on origin, packing and peach. The Discrete Choice Experiment does not estimate how much consumers are willing-to-pay for the best or the worst product, i.e., considering all other quality characteristics.

Figure 5.1 deals with this issue. DCE measures the consumers' WTP between quality 1 (which based on studied characteristics, it can be considered as the lowest quality) and 2 (highest quality). Considering the model as additive, the WTP of changing quality 1 for quality 2 is the sum of WTPs from all studied attributes for moving from the worst to the best attribute-level. Quality 0 (zero) is the minimum quality that consumers demand to accept the product because their WTP is zero. The WTP between the lowest quality (quality 0) and the intermediate quality (quality 1) is unknown in the DCE, as consequence, total WTP is also unknown.

Figure 5.1 An alternative model to adjust the willingness-to-pay



To estimate the value of total WTP it is necessary an anchor variable, i.e, one variable that is used as reference. Theoretically, this reference should indicate the consumers' WTP at one quality level (at quality 1 or quality 2) and then it is possible to estimate the WTP in other quality level.

In relation to Hypothetical bias, if one knows the WTP at quality 1 and at quality 2 through other source, the TWP from the DCE can be adjust. It was carried out one experiment (please, see Part II A of survey in the appendix 2) in 2009 following that approach. This experiment has been developed since the method proposed by Eggers and Sattler (2009). They made a dynamic experiment were consumers selected the most and worst important attributes and their respective levels. Their aim was to carry out a conjoint analysis only with the most relevant characteristics. However, as mentioned by Louviere *et al.* (2009), making estimations with different prices ranges can generate biased results. Thus, in this study, this experiment was used only for the WTP range adjustment between peaches with intermediate and highest quality.

In the survey, the experiment began with a short presentation of late season peaches characteristics. Consumers had to build two hypothetical peaches with the different combination of attribute-levels (origins, packing and peaches sizes). It was explained that the peach with highest quality would result from the best chosen characteristics (attributes-levels) and the peach with lowest quality would result from the worst chosen characteristic. The objective of this part of the experiment was to provide consumers one peach with intermediate quality (quality 1) and other peach with highest quality (quality 2). Consumers were asked about the maximum price that they were willing-to-pay for the peach with highest quality (WTP at quality 2) and for the peach with lowest quality (WTP at quality 1).

In total, 212 consumers of PDO Calanda peaches participated in the survey of 2009. Table 5.7 presents the number of times that each attribute-level was selected by consumers as the best and the worst late season peaches' characteristic. Peaches from Calanda area with PDO was chosen by 201 consumers (94.8%) as the best origin-level and only 3 consumers (1.4%) selected as the worst characteristic. Peaches from other area without PDO are the worst origin-level because 187 consumers choosed it as the worst option and 4 choosed as the best. Thus, it is the least prefered origin-level.

Concerning peaches size, the medium size peach was stated as the best size for 108 consumers (50.9%), largest size for 97 consumers (45.8%) and smallest size was mentioned as the best size for 7 consumers (3.3%). Smallest size was mentioned as the worst size for 166 consumers while largest size had the same consideration for 41 consumers and the medium size for 5 consumers. Thus, according to consumers' preferences, the best size is medium peaches and it is followed by largest size and smallest size.

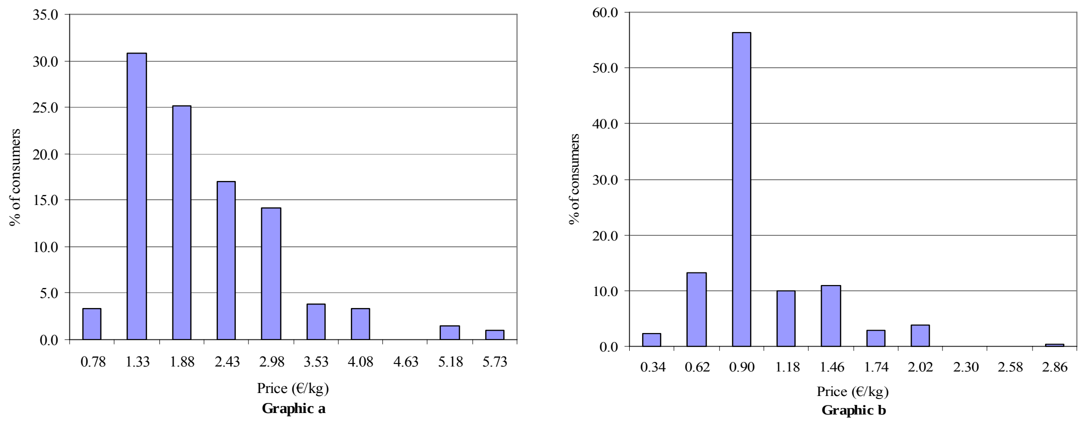
This experiment shows that bulk peaches are the most appreciated selling format. Almost 70% of consumers stated that this selling format is the best type of packing while around 18% think that it is the worst type of packing. Although normal packing was mentioned more often as the worst packing than best, it is the second best packing because active packing was selected as the worst option for 117 consumers (55.2%) and as the best alternative for only 36 consumers (17%).

Table 5.7 Number of times that each attribute-level was selected as the best and the worst late season peaches' characteristic

	Nº of consumers		% of consumers	
	Best	Worst	Best	Worst
From Calanda area with PDO	201	3	94.8	1.4
From Calanda area without PDO	7	22	3.3	10.4
From other area without PDO	4	187	1.9	88.2
Bulk peaches	144	39	67.9	18.4
Normal packing	32	56	15.1	26.4
Active packing	36	117	17.0	55.2
Smallest size	7	166	3.3	78.3
Medium size	108	5	50.9	2.4
Largest size	97	41	45.8	19.3
Total	212	212	100.0	100.0

The distribution of consumers that mentioned different maximum WTP for peaches with the best attributes-levels (at quality 2) and the worst attributes-levels (at quality 1) are plotted in the Graphic 5.3. The maximum WTP for peaches with the best attribute levels vary from 0.50€/kg to 6.00€/kg (average of 2.21€/kg) whereas the maximum WTP for peaches with worst attributes-levels vary from 0.20€/kg to 3.00€/kg (average of 1.05€/kg). Comparing both graphics, it is possible to verify that consumers are distributed less concentrated around the mean, in the case of maximum WTP for peaches with quality 2 (Kurtosis of 2.9) than in the case of peaches with quality 1 (Kurtosis of 3.4). In total, 56.4% of consumers mentioned to be, at most, WTP between 0.76 and 1.04€/kg (0.9€/kg, on average) for peaches with quality 1 and it means that the greatest part of consumers value the others peaches characteristics similarly. The greater dispersion of maximum WTP for peaches with quality 2 means than consumers value origin-levels, the packing-levels and peach sizes-levels, differentially.

Graphic 5.3 Maximum WTP, in €/kg of peach, distribution for peaches with highest quality (a) and lowest quality* (b)



Note: (*) Here the lowest quality corresponds to quality 1.

The maximum WTP for the considered characteristics is estimated to be 1.16€/kg. It was calculated from the difference between maximum WTP for peaches with quality 2 (2.21€/kg) and for peaches with quality 1 (1.05€/kg) and it is 1.16€/kg. Assuming that peaches with quality 1 and 2 in both surveys have the same profile, than the WTPs in Table 5.6 can be adjusted by a factor. This factor was calculated dividing 8.44€/kg, that represents the WTP to change peaches with quality 1 to others with quality 2 in survey of 2008, by 1.16€/kg that have the same meaning in the 2009 survey. The product of this division is 7.276. Hence, all WTP from Table 5.6 were divided by 7.276 and the grades as shown in the Table 5.8.

Origin, i.e., where peaches were produced is also very important for consumers. On average, the AWTP to change peaches produced in other areas without PDO to peaches produced in Calanda area also without PDO is 0.35€/kg. The oldest consumers (50 years old or older) present the highest WTP for peaches' origin (0.46€/kg) and consumers with no high loyalty degree toward PDO Calanda peaches (those who would buy a peach or another stone fruit) as well as sporadic consumers have the smallest WTP (0.27€/kg) for origin.

Table 5.8 Adjusted Willingness-to-Pay (AWTP), in €/kg, for consumers' groups and for the market as a whole, of late season peaches' characteristics in Zaragoza city, in 2008.

	Frequency		Loyalty		Gender		Education level		Age (years old)		Household income		
	Regular	Sporadic	High	No high	Women	Men	Elemental	No elemental	50 or older	Younger than 50	Less than 1,500	More than 1,500	On Average
- From Calanda area without PDO to from Calanda area with PDO……….....	0.63	0.28	0.49	0.40	0.59	0.34	0.71	0.39	0.78	0.34	0.65	0.38	0.46
- From other area without PDO to from Calanda area without PDO………	0.43	0.27	0.40	0.27	0.42	0.28	0.37	0.34	0.46	0.31	0.29	0.37	0.35
- Bulk peaches to normal packing……..........	0.12	0.09	0.15	0.13	0.17	0.10	0.20	0.09	0.20	0.09	0.20	0.08	0.10
- Normal packing to active packing……….	-0.19	-0.14	-0.30	-0.14	-0.35	-0.12	-0.40	-0.12	-0.41	-0.12	-0.27	-0.14	-0.15
- Smallest to medium size*………..............	0.23	0.12	0.18	0.15	0.22	0.13	0.23	0.16	0.25	0.14	0.19	0.17	0.17
- Medium to the most appreciated size*…	0.05	0.02	0.03	0.03	0.03	0.03	0.04	0.03	0.03	0.03	0.04	0.03	0.03
- The most appreciated to the largest size*..	-0.06	-0.03	-0.05	-0.04	-0.08	-0.02	-0.06	-0.04	-0.11	-0.02	-0.05	-0.04	-0.04
- The most appreciated peach size (g)……..	312	307	310	310	302	325	309	310	297	321	311	310	310

Note: (*) small size ~ 160g, medium size ~ 250g and largest size ~ 380g and the most appreciated size is determined for each group according to the last three sizes

Comparing the brand and the origin, on average, consumers are willing-to-pay 30.9% more for brand than for origin. However, this difference is higher (128.9%) for those consumers with smallest household income (less than 1,500 Euros/month) and smaller (1.30%) for consumers with highest household income (more than 1,500 Euros/month). It means that origin is almost as important as brand for consumers with highest household income and consumers with smallest income give much more importance to PDO Calanda peaches brand.

Regarding the evaluation of packing in 2008, consumers preferred products with high convenience and natural. On average, consumers were willing-to-pay 0.10€/kg to shift bulk peaches from peaches conditioned in normal packing. Nevertheless, although active packing allows longer storage period without any consequence, consumers valued active packing as a product with lower quality than normal packing (they are willing-to-pay 0.15€/kg for changing active to normal packing).

Within group, the greatest difference on preferences for normal packing is found between household income segments. Consumers with highest household income are willing-to-pay up to 0.08€/kg to buy peaches in normal packing than in bulk while for those with smallest income this value is 0.20€/kg, which is a difference of 154.2%. The smallest difference of this perception is found for consumers with different loyalty degree toward PDO Calanda peaches. Consumers with high loyalty degree are only willing-to-pay 16.3% more for peaches in normal packing than bulk peaches.

In relation to active packing, refusing the greatest variation in WTP is detected on consumers' age. The oldest consumers have stronger disliking for active packing because they are willing-to-pay up to 0.41€/kg to change peaches conditioned in active packing to peaches sold in normal packing whereas the youngest consumers are willing-to-pay 0.12€/kg for this shift (the WTP of oldest is 154% higher than the youngest WTP). The smallest difference in WTP is found between regular and sporadic consumers. Regular consumers are willing-to-pay only 36.14% to change from active to normal packing.

Regarding peach size, on average, consumers are willing-to-pay to change from small to medium size peaches a total of 0.17€/kg, and to change from medium size peaches (250g) to the most appreciated size (310g), they are willing-to-pay a plus of

0.03€/kg. The largest size peaches were considered too large for consumers and they would be indifferent if there was a compensation of 0.04€/kg to change from a most appreciated size to the largest size. It shows that the entire market is less sensitive toward peach size when the size is between 250g and 310g.

Oldest consumers are very sensitive to peaches size. Although the most appreciated peach size for them, weights 297g, they have the highest WTP (0.25€/kg) to change from small to medium size peach (they really dislike small size peaches) as well as the highest Willingness-to-Accept Compensation (WTA) of 0.11€/kg to change from the most appreciated peach size to the largest.

Sporadic consumers are those who present the smallest WTP (0.12€/kg) to change from small peaches to medium size as well as the smallest WTP (0.02€/kg) to shift from medium to the most appreciated size (307g) while regular consumers have the highest WTP (0.05€/kg) to change from medium to most appreciated size. Men as well as youngest consumers (younger than 50 years old) have the smallest WTA (0.02€/kg) when peaches size goes from the most appreciated to the largest size.

5.4 Final remarks

Protected Designation of Origin (PDO) is a geographical indicator defined in the European Union law to protect the name of regional foods. This law considers that only food products proved that come from a particular region are allowed to be marketed as such. With respect quality, it is implied that it is significantly or exclusively determined by the geographical environment, including natural and human factors.

Although peach (*Prunus persica*) is a native specie from China, it was introduced to Persia and the Mediterranean region along the Silk Road before Christian times. There are reports affirming that peaches were brought to Spain by the Roman. In Spain, different regions produce peaches in different periods of the year because natural conditions vary a lot and, for example, the Calanda area offers peaches at the end of the season. In this case, local environment provides adequate conditions to produce peaches with special quality.

The reputation of peaches produced in Calanda area is a consequence of their differentiated quality. The Regulatory Council of PDO Calanda peaches takes care of control quality. This organization, determining and controling the peaches quality, it also certificates the product authenticity with their brand. Producing peaches under a PDO brand is more expensive, but the product may be commercialised with higher prices.

One of the main objectives of this study was to estimate the magnitude of this premium price in Zaragoza city by stated preferences methods. The average of consumers' willingness-to-pay for peaches produced in Calanda area and the price difference that they are willing-to-pay for a certified product was calculated by two steps. The first step used a Discrete Choice Experiment of different profiles, where consumers stated the best and the worst options in each choice set, carried out in 2008.

In this step, 7 descrete choice models were also compared. The conditioned model (Model 2) presented better fitting (higher adjusted R^2 and lower CAIC) than unconditioned model (model 1), but their estimated parameters have similar accuracy (t-values). When the number of observations increases, by considering the worst option choices, the model fitting decreases (adjusted R^2 and CAIC increase) and parameters accuracy increases (it increases their t-value). Similar effect is detected if it is improved the number of alternatives in each observation.

The Bottom-up model, which initially was supposed that it would have the best performance, has the worst performance to estimate preferences at sample level. Its fitting has the lowest adjusted R^2, the highest CAIC and its parameters, although statistically different from zero, have the lowest accuracy (t-values).

It was also found that the Best-Worst coding system provides consistent results. It means that when there are two options, A preferable to B, and if coding option A is 1 (this coding can be given to one particular level of attribute or one attribute by it selve) in the input matrix and if the best options choices are taken into account to calculate the log likelihood function, the estimated parameters are the same than considering the worst option choices but with option A coded -1. These estimations can be undertaken if they represent the same preferences.

In order to compare the best and the worst options, the model 6was calculated (simultaneous BW with scale factor). This model was introduced to provide the scale factor and it allows calculating the variance between the best and the worst options. It was observed that the variance of worst options is 46.4% higher than the variance of the best options. It means that there is higher homogeneity for the best options than for the worst. For example, greater proportion of people prefers medium size peaches but the disliking of smallest or largest size peaches is not homogeneous.

Although the worst options have higher variances, the marginal utilities of all approaches state that peaches not produced in the Calanda area without PDO brand, with smallest (weighting around 160g) size and sold in Zaragoza city conditioned in active packing have, on average, the lowest quality. And, peaches with the best quality are those produced in the Calanda area with PDO brand, weighting around 310g and sold in bulk (boxes).

The heterogeneity on preferences was estimated with interaction effects between late season peaches' and consumers' characteristics. One model for consumers with different PDO Calanda peaches consumption frequency (regular and sporadic) was calculated, other model for loyalty degree (highly loyal or not), and so on for gender, education level (elementary or not), age (younger than 50 or who are 50 or older) and household income (less or more than 1,500€/month). It was found that the marginal utility of shifting medium size peaches for smallest size peaches are not statistically different among consumers, but consumers with different gender and age have different utility if they change medium to largest size peaches. Men and youngest consumers prefer larger peaches than women and oldest consumers. Another finding is that regular consumers as well as those with high loyalty, women, elementary education, oldest and consumers with household income below to 1,500€/month are less sensitive to price than sporadic, no high loyalty, men, no elementary education, youngest and with household income higher than 1,500€/month, respectively. And this finding had consequences when their WTP were calculated.

Hypothetical bias was detected in the results of the first experiment (survey 2008). Thus, it was presented a second experiment in the survey of 2009. Although the economic conditions were not the same between these two years, the second experiment allowed to calculate a range of prices between two quality levels, peaches with the best quality were defined as those with most desired levels of attributes and peaches with the worst quality, otherwise. On average, consumers maximum WTP for peaches with the worst attributes-levels is 1.05 €/kg while for those with the best attributes-levels (the best quality) is 2.21 €/kg.

The hypothetical bias in WTP was estimated by a factor of 7.276, which means that WTP values from the first estimations could be 727.6% over estimated than what currently consumers could pay. Thus, as a final result, it is estimated that consumers are willing-to-pay up to 0.46€/kg to change peaches from Calanda area without PDO Calanda to peaches from Calanda with PDO. It means that the PDO brand can be valued in 0.46€/kg. They also value positively those peaches produced in Calanda area. Consumers are willing-to-pay up to 0.35€/kg to change late season peaches produced in other area to peaches produced in Calanda area, *ceteris paribus*.

Both experiments suggest that, on average, consumers prefer medium size (weight of 250g) peach in comparison to the smallest (160g) or largest size (380g) and they have higher disutility with smallest than largest size peaches. The most appreciated peach size, for the entire market, weights 310g. The estimated value to change a smallest peach to the most appreciated peach size is 0.2€/kg and consumers' Willingness-to-Accept (WTA) to change peaches with most appreciated size to other peaches with largest size is 0.04€/kg.

Although men and young people have stronger preferences for larger peaches, they have lower WTP to change from the smallest size peaches to the most appreciated size. For example, women are willing-to-pay 0.25€/kg for this change while men only 0.16€/kg, which accounts for a difference of 56.2% in relation to women's WTP and youngest are willing-to-pay 0.17€/kg for this shift whereas oldest are willing-to-pay 0.28€/kg, i.e., oldest are willing-to-pay 64.7% more for this change than youngest. The smaller WTP of men and young consumers to buy larger peaches can be explained by their higher disutility with price.

Peaches sold in active packing have higher quality than those conditioned in normal packing. Our study shows that consumers perceive peaches in active packing as a product with lower quality than those in normal packing. When the type of packing is changed from normal to active, consumers have to be compensated with 0.15€/kg to maintain the previous utility level. Although there were not found statistical differences between normal packing and bulk peaches, i.e., consumers were indifferent between these two kinds of packing, they were willing-to-pay 0.10€/kg to change bulk peaches for those sold in normal packing.

Theoretically, the experiment of 2009 can also estimate how much consumers value each peach characteristic. Thus, why these results were not used in this study? The reason is that, in the experiment of 2009, consumers only traded-off among different levels of the same attribute while in the choice experiment of 2008 they made the trade off among all attribute levels. The experiment of 2008 is also more similar of a purchase situation than in 2009, thus, it is expected that it is more able to predict future consumers' behaviour with more accuracy.

Chapter 6: Individual preferences for late season peaches' attributes-levels

6.1. Intrioduction

Chapter 5 deals with consumers' preferences toward late season peaches characteristics with estimations at sample level. There, it was supposed that the preferences are normal distributed acroos consumers and that they are not correlated. According to Louviere *et al.* (2009) if preferences toward different product's characteristics, measured by marginal utility, are correlated or are not normal distributed among consumers, the average preference (the marginal utility calculated from all sample) can be biased.

One way to solve this problem is to calculate Individual Utility Functions (IUF), that is, one utility function for each consumer in the sample. In this process it is not necessary to make any assumption about preferences distribution or correlations among consumers. It only takes into account that the preferences of one person are normally distributed and uncorrelated, which is a weaker condition than estimations for all sample.

Louviere *el at.* (2009) propose an alternative method to estimate IUF, called the Bottom-up. They describe the consumers' preferences individually and they consider the statistical significance of estimated marginal utility. However, their sample has few consumers. On the other hand, Islam (2008) estimated individual preferences with the Bottom-up model for larger sample and compared the predictability of Bottom-up model with Mixed model and Hierarchical Bayes. Both studies do not cluster consumers according to their preferences.

As explained in the previous chapter, the Bottom-up model was suggested to estimate preferences for each consumer because it combines an optimal experimental design with the Best-Worst Choice Experiment (BWCE) and with an alternative approach to estimate utilities. The optimal experimental design is obtained when the levels of attributes combination results in D-efficiency of 100%. It implies that with this combination the smallest number of observations is demanded. According to Louviere *et al.* (2009), in order to estimate individual preferences it is necessary to employ the choice task in which consumers have lowest standard deviation in their responses. They justified the BWCE because respondents have better ability to recognise extreme options and then responses have lower standard deviation. In the estimation process, it is considered that consumers have chosen all alternatives in the choice set, which increases the number of observations, and the number of alternatives in each choice may be maintained.

This chapter deals with studying consumers' preferences toward late season peaches in Zaragoza city, but at individual level. First it is compared the Bottom-up model's performance in comparison to Traditional Discrete Choice Experiment (TDCE), Sequential Best-Worst Choice Experiment (BWCE) and Simultaneous Best-Worst Choice Experiment (SBWCE) performances. Comparing those approaches will give an idea about the impact of the number of observations and the number of alternatives in each observation on model performance.

It is estimated the preferences distribution across consumers with the approach who had best performance, that is, with that approach which produced greatest parameters statistically significant at 10% of p-value (it is the lowest accuracy acceptable in most empirical studies). When the preference distribution is measured, it is not imposed any statistical restriction, such as considering only the estimated parameters statistically different from zero.

The statistical restriction is imposed for individual preferences description. The preferences are described based on IUF and consumers are grouped according to the late season peach characteristics distinguished by them. In this study, two levels of consumers' classification are carried out and differences are taken into consideration for consumers' socio-economic differences as well as differences on attitudes toward PDO Calanda peaches consumption in each classification level.

6.2 Empirical model

The experimental design is detailed in the section 5.2.2.1 (Chapter 5). The survey is the same than the survey used in the last chapter, but now one utility function per consumer is estimated. The empirical model changed, because in Chapter 5, price is taken into account as a numeric variable, but now it is calculated as a categorical variable. Equation 6.1 represents the average utility (V_{iq}) that consumer *q* has with the option *i*. It was calculated one utility function for each consumer. In this individual level analysis, the utility functions were called Individual Utility Function (IUF). At this level, price was considered as categorical variables in IUF because it was possible to estimate the number of consumers who considered price as a quality cue.

$$V_{iq} = \beta_{i1q}\, price_1 + \beta_{i2q}\, price_2 + \beta_{i3q} origin_1 + \beta_{i4q} origin_2 + \beta_{i5q}\, packing_1 + \\ + \beta_{i6q}\, packing_2 + \beta_{i7q} size_1 + \beta_{i8q} size_2 \qquad 6.1$$

Where:

Price$_1$ = price is a categorical variable. Thus, when an alternative is chosen as the best option of the choice set: if the price of the alternative is 1.5€/kg, it is 1; if the price of the alternative is 2.5€/kg, it is -1; and if the price of the alternative is 3.5€/kg, it is 0. When an alternative is chosen as the worst option of the choice set, then if the price of the alternative is 1.5 €/kg, it is -1; if the price of the alternative is 2.5€/kg, it is 1; and if the price of the alternative is 3.5€/kg, it is 0.

Price$_2$ = price is a categorical variable. Thus, when an alternative was chosen as the best option of the choice set: if the price of the alternative is 1.5€/kg, it is 0; if the price of the alternative is 2.5€/kg, it is -1; and if the price of the alternative is 3.5€/kg, it is 1. When the alternative is chosen as the worst option of the choice set, then if the price of the alternative is 1.5€/kg, it is 0; if the price of the alternative is 2.5€/kg, it is 1; and if the price of the alternative is 3.5€/kg, it is -1.

6.3 Exploring markets segments with Individual Utility Functions

When preferences are studied by calculating Individual Utility Functions (IUF), that is one utility function per consumer, it is not necessary to make assumptions about the preference distribution across consumers. As mentioned earlier, Louviere *et al.* (2009) propose an alternative method to estimate individual preferencesa and it is called the Bottom-up model. The main advantage of this method is to improve the number of observations by consumer, in order to generate greater number of parameters statistically different from zero. Their paper describes consumers' preference basing on those parameters statistically different and equal to zero.

The estimated parameter of attribute-level *i* measures the consumer's marginal (dis)utility when he changes a product with attribute-level of reference by other product with attribute-level *i*. If the estimated parameter is statistically equal to zero, it means that consumers is indifferent between the attribute-level of reference and attribute-level *i*. For estimation purpose, each consumer makes few choices and most statistical methods will provide few parameters statistically different from zero. It means that, at individual levels, most statistical methods say that consumers are indifferent among products' characteristics.

If only some people would distinguish attribute-levels, preferences description would be poor. Thus, the deseared statistical model is that one that provides more parameters statistically different from zero. In this chapter, different models are compared in order to select that one who gives greater number of consumers who are not indifferent among late season peaches characteristics. In this case, statistical criterias, such as, CAIC and adjusted R^2 are not relevant to describe consumers' preferences.

In their paper, Louviere *et al*. (2009) do not compare the performance of the Bottom-up model with other models. In our case, 316 Individual Utility Functions have been estimated (one by each PDO Calanda peaches consumer) by Traditional Discrete Choice Experiment (TDCE), 316 Individual Utility Functions (IUF) by the Sequential Best-Worst, 316 IUF by the Simultaneous BW and 316 IUF by the Bottom-up model. The estimations have been carried-out with the Biogeme software version 1.7, which was developed by Barbiere (2008) and the main results are displayed in the Table 6.1.

Table 6.1 Performance of different models to estimate IUFs

p-value	Model 2 TDCE	Model 4 Sequential BW	Model 5 Simultaneous BW	Model 6 Bottom-up
40%	122	134	786	749
20%	7	59	411	437
10%	0	25	184	280
5%	0	11	47	150
1%	0	0	0	68

In the case that all IUF had all parameters different from zero, there were (316 consumers * 8 parameters per consumer) 2,528 parameters are considered because their nulls hypothesis are refused. Table 6.1 points that IUF estimated by the TDCE approach provides 122 parameters different from zero when p-value is 40% (p-value of represents an accuracy of 60%) and 7 parameters statistically different from zero at 20% of p-value.

There are only 9 observations per consumer (one per choice set) in TDCE. This number increases to 18, in BW models. The difference in the number of statistical significant parameters of models 4 and 5 is explained by the available alternatives in the second choice. Model 4 considers that the second choice is undertaken between two alternatives while model 5 considers that consumer is deciding among three alternatives. The impact of this assumption is clearly noted in the 3rd and 4th column of Table 6.1. There are many more parameters statistically different from zero, at all p-values, in model 5 than in model 4.

Among the considered models, the Bottom-up model has the highest performance at individual level. It is the only model able to generate parameters statistically different from zero at 1% of p-value. At 5% of p-value, the number of generated parameters different from zero is 3 times more than the number of generated parameters from model 5. At 10% of p-value, there are 280 parameters statistically different from zero in the Bottom-up model while there are 184 parameters in the Simultaneous BW.

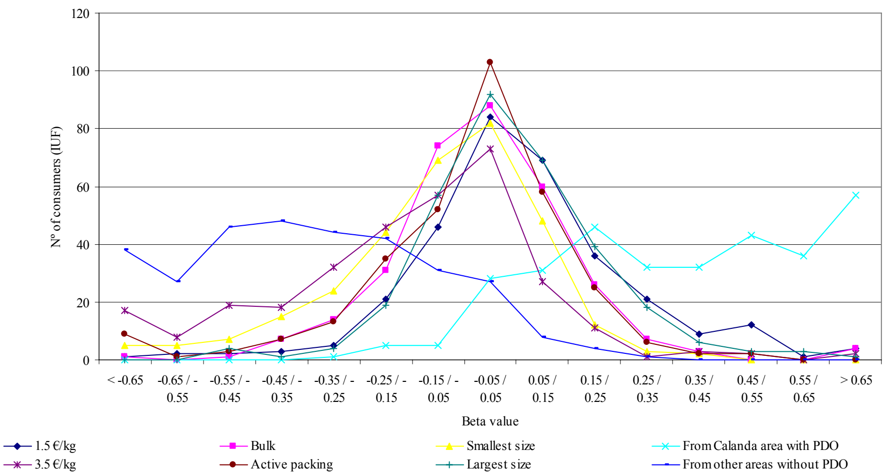
Respondents discriminate one attribute-level from the attribute-level of reference, at a determined probability level, when the null hypothesis of that parameter is refused. Otherwise, if the null hypothesis is accepted, it means that consumers are indifferent between both attribute-levels. That model is able to calculate a great number of parameters with higher accuracy and it can provide more detailed description about consumers' preferences. As an extreme example, if a model does not produce any parameter different from zero, it would mean that consumers are indifferent among considered profiles' characteristics. In this order, as the Bottom-up model generated the greatest number of parameters different from zero, it is employed for describing consumers' preferences for late season at individual level.

6.3.1 Individual preferences without statistical significance restriction

In this section it is not imposed any statistical restriction. The aim is to value the preference distribution across consumers for each attribute-level. Graphic 6.1 shows the preference distribution of the estimated utilities distribution, of different price levels (low price or 1.5€/kg and high price or 3.5€/kg), origin levels (peaches produced either from Calanda area with PDO or from other areas without PDO), packing levels (bulk peaches and peaches conditioned in active packing) and peaches sizes levels (smallest and largest size peaches). In these comparisons it is assumed that the error terms of all IUF are the same, otherwise IUF would have different scale factors and a direct comparison could not be established without estimating the relative scale factor (Louviere *et al.*, 2000). Thus, it is supposed that responses from all consumers have the same variance.

The normal distribution is a continuous probability distribution around the mean and its probability density function is bell-shaped, with a peak at the mean. Based on Graphic 6.1, it is possible to note that there are evidences of lacking normal distributions for some attribute-levels. Both origins' levels are not bell-shaped and the attribute-level from Calanda area with PDO has a tendency to assume positive values and the attribute-level from other area without PDO has the opposite tendency. Apparently, the preference distribution of high price (3.6€/kg) is skewed toward negative values. Those results are not a surprise because Islam (2008), using the Bottom-up model, finds that preference distributions for all prices levels were not normally distributed.

Graphic 6.1 Preference distribution for each late season peaches' attribute-level



Based on that evidence, the Kurtosis, Skewness and Kolmogorov-Sminov and Shapiro-Wilk statistics and statistical significance, that are used to value more objectively how well preferences distributions performs as a normal distributions are calculated, for every parameter distribution. According to SPSS (2004), when probability density function is normally distributed it has the Kurtosis statistics of 0 (mesokurtic distribution) and Skewness statistics is also 0 (zero). Kurtosis statistics measure the dispersion of data around the mean. When Kurtosis value is positive the dispersion is leptokurtic and platykurtic if it is negative. Leptokurtic dispersions mean that observations are more clustered around the mean than in a normal distribution and for platykurtic the dispersion is less clustered around the mean. Skewness equal to zero happens when the distribution is symmetric around the mean, if its value is negative the distribution has a long left tail and if it is positive the distribution has a long right tail.

Table 6.2 shows the average utility, Kurtosis and Skewness values from parameters of each attribute-level. The utilities distributions of peaches "from Calanda area with PDO" and "from other areas without PDO" are less dispersed around the mean than any other estimated variable and they are more spread than in a normal distribution because their Kurtosis statistics are -0913 and -0704, respectively. Bulk peach utilities are more centred on the average value (-0.01) than any other variable.

Table 6.2 Normality distribution test for every estimated parameter

Variables	Average	Kurtosis	Skewness
Low price – 1.5€/kg	0.06	1.784	0.143
High price – 3.5€/kg	-0.15	0.712	-0.208
From Calanda area with PDO	0.36	-0.913	-0.323
From other area without PDO	-0.34	-0.704	0.166
Bulk peaches	-0.01	3.419	0.477
Active packing	-0.04	2.640	-1.001
Smalles size	-0.10	1.312	-0.891
Largest size	0.04	2.120	0.392

Regarding the asymmetry, "active packaging" has the Skewness of -1.001 (left-skewed), which means that there are more betas with lower utility values than the average utility. This asymmetry is also checked for the betas distribution of parameters such as "from Calanda area with PDO", "high price" and “smallest size” peaches. On the other hand, there are more betas with higher values than the average utility

(Skewness > 0) for "bulk", "largest size", "from other areas without PDO" and "low prices" peaches. The kurtosis and the skewness are pointing that, for example, PDO Calanda peaches brand value and Calanda production area can be under evaluated at sample level.

The Bottom-up model also allows the estimation of consumers that have positive or negative utility with a particular parameter. According to the estimations, 57.3% of consumers have positive marginal utility with low price while 22.8% have with high price. This difference increases when the marginal utility of origins levels are taken into consideration. Almost 95% of consumers have positive marginal utility with “from Calanda area with PDO” and only 7% have positive marginal utility with “from other area without PDO”. Regarding packing types, 40.5% of consumers have positive marginal utility with bulk peaches (they prefer bulk peaches over peaches conditioned in normal packing) and 45.6% of consumers have positive marginal utility with active packing. In relation to peach size, 34.8% of consumers have positive marginal utility.

In all cases, preferences are not normally distributed around the mean. The normal distribution of consumers’ utilities, in a sample, is the basic requirement in multinomial estimates (Louviere *et al.*, 2000). However, results of IUF show that the real probability distribution functions may not be normally distributed among consumers and it implies that estimations with log likelihoods functions, which suppose preferences normally distributed, would produce biased estimations. Thus, describing the consumers’ preferences with the Bottom-up model will not produce wrong conclusions.

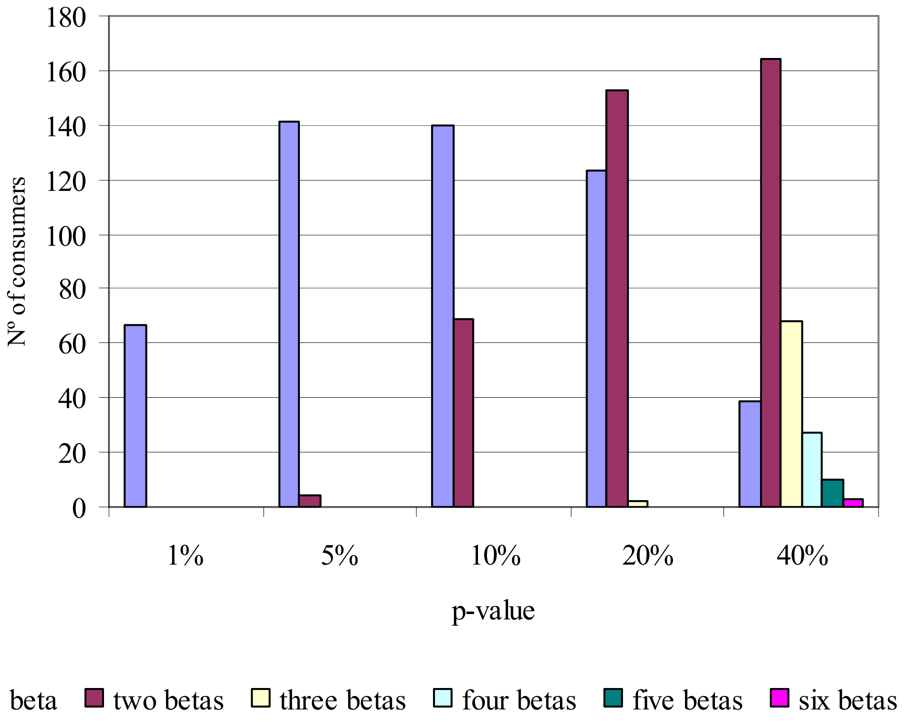
6.3.2 Individual preferences with statistical restriction

Normally, in empirical studies, statistical significance levels of 1%, 5% and 10% are considered (often measured by p-value) and these levels represent different precision levels. If the null hypothesis is refused, at 1% of statistical significance, it means that there is an effect (parameter is different from zero) with a probability (currency) of 99%. Thus, it is supposed that the statistical significance of 1% is the most restrictive, with highest accurate results, while 10% of statistical significance is the least restrictive, with lowest accurate results.

Graphic 6.2 shows how the Individual Utility Functions (IUFs) structure change when different p-values are considered. For example, at 1% p-value, there are only IUFs with one parameter statistically different from zero (when null hypothesis is refused at 99% of confidence). It means that, at this probability level, consumers have distinguished only one attribute-level on their purchase decision. In this case, there are 75 (23.7% of 316 consumers) consumers who have their preferences described by those attribute-levels while the rest 241 (76.3%) can not provide any preference information because, theoretically, they are indifferent between attribute-levels.

At the least restrictive condition, p-value of 10%, the analysis becomes less accurate, but the number of consumers who have considered one or more attributes-levels on their buying decision increases to 209, which represents 66.1% of the total sample. The number of consumers (measured by IUFs) who have distinguished one attribute-level from the attribute-level of reference is 140 (2/3) and there are 69 consumers (1/3) who took in account two attribute-levels on their decision. It is found that, 32 consumers who only considered one attribute-level at 1% of p-value, now (at 10%) differentiate two attribute-levels.

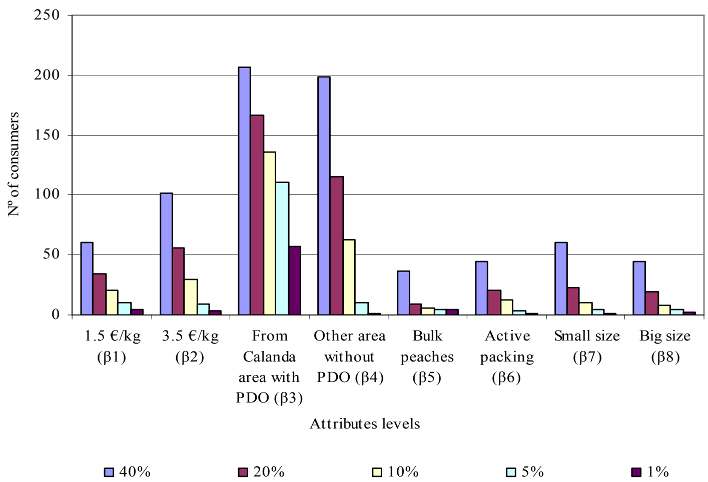
Graphic 6.2 Number of statistical significant variables per IUF according with t-value



Graphic 6.2 also shows that, at 20% of p-value, there are 279 consumers (88.3%) who made decisions based on one or more peach's characteristic. From those consumers, 123 considered one attribute-level, while 154 distinguished two attributes-levels and only 2 three attribute-levels. At 40% of p-value, individuals' preferences change a lot. Consumers differentiated up to 6 attribute-levels on their statements. The number of consumers who have considered at least one attribute-level is 311 (98.4%), which represents almost all sample.

The following graphic (Graphic 6.3) shows the impact of changing p-value in the number of parameters statistically different from zero for each variable. These impacts affect differently each variable. For example, at 40% of p-value, 207 consumers have made their hypothetical purchase distinguishing peaches "from Calanda area with PDO" of peaches "from Calanda area without PDO", 199 distinguished "from other area without PDO" of "from Calanda area without PDO" and 36 consumers had (dis)utility of changing peaches conditioned in "normal packing" to peaches in "bulk". At 1% of p-value, consumers have made their hypothetical purchase distinguishing peaches "from Calanda area with PDO" from peaches "from Calanda area without PDO" for a reduced number of 57 consumers, nobody (there is no parameters statistically different from zero) distinguished "from other area without PDO" from "from Calanda area without PDO" and only 4 consumers had (dis)utility to change peaches conditioned in "normal packing" from peaches in "bulk".

Graphic 6.3 Number of IUF with each attribute-level different from zero at different p - value



6.3.2.1 Individual preferences with statistical restriction at 10% of t-value

Although accuracy (p-value) may affect the preferences description, by changing the number of parameters within IUF and it has different impact in each variable, this section describes preferences at 10% of p-value. This accuracy level was selected because it is accepted in most empirical studies and, at this level, 66.1% of consumers are not indifferent with late season peaches characteristics.

Taking off those parameters who are not statistically significant at 10% of p-value, the distributions of utilities change in comparison to the original distribution (Graphic 6.1). The new distribution is plotted in Graphic 6.4. For example, Graphic 6.4 (b) shows that consumers only have positive utility when they change peaches "from Calanda area without PDO" to "from Calanda area with PDO", i.e., there are not consumers that dislike the PDO Brand. On the other hand, consumers who consider the attribute-level "from other area without PDO" only have negative utilities. On their decision, they rather prefer peaches produced in Calanda area than those produced in other areas.

Regarding the price, Graphic 6.4 (a) shows that there are 17 consumers who have marginal utility smaller than -0.65 with high price (3.5€/kg) whereas only one consumer has the same marginal utility with low price (1.5€/kg) and 12 consumers have marginal utility between 0.45 and 0.55 with low price while one consumer has marginal utility in this range.

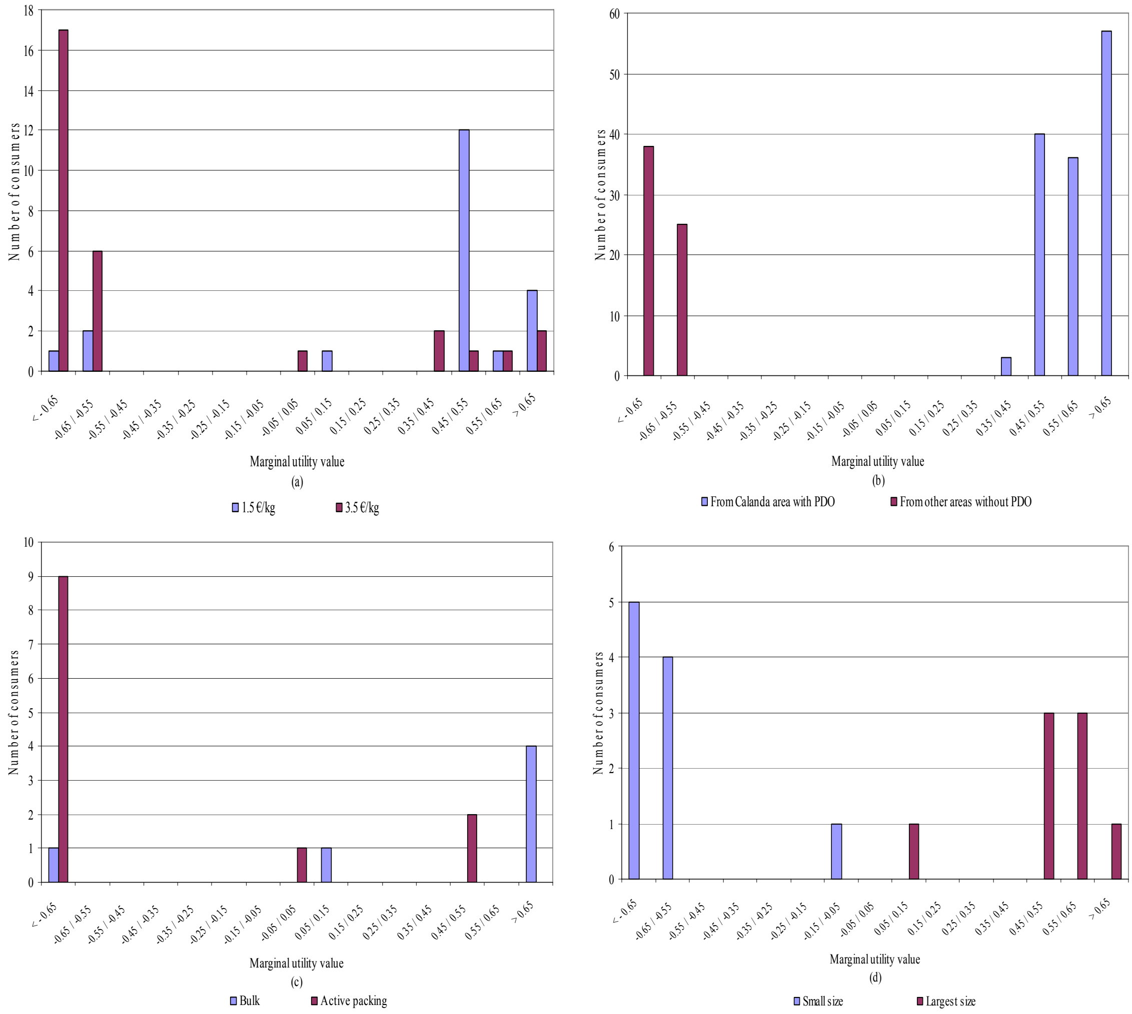
Regarding packing, 9 consumers have greater disutility of -0.65 when normal packing is changed to active packing and 2 consumers have marginal utility between 0.45 and 0.55 when the same shift is produced. It means that although some consumers would reather prefer active packing to normal packing, the greatest part of consumers who considered this characteristic strongly dislikes it. Fewer consumers differentiated bulk peaches from those in normal packing. Four consumers have greater utility than 0.65 with this kind of packing and only one have lower utility than -0.65.

Graphic 6.4 (d) present the number of consumers that have (dis)utility with smallest and largest peaches sizes. Eight consumers have positive utility if a change from medium to largest size is proposed and one of them has an utility greater than

0.65. However, 5 consumers have higher disutility than -0.65 when it is changed peaches with medium size to smallest size.

Graphics 6.4 (a, b, c, and d) provide good information regarding the number of consumers who have considered each attribute-level and their distributions across the sample. As mentioned in section B.2, at 10% of p-value, there are consumers who differentiated one or two characteristics. For this reason, it does not allow new comparisons among different attribute-levels. Table 6.3 present the number of consumers, per attribute-level, that considered one or two attributes-levels on their choice, at 10% of p-value.

Graphic 6.4 Number of people in each estimated beta class, at 10% of statistical significance, for each parameter



From 280 IUF with one or more parameters statistically different from zero, two thirds represents consumers that differentiated one attribute-level from the attribute-level of reference on their buying decision and the rest differentiated two attribute-levels. Major part (62.9%) of consumers, who differentiated one attribute-level, are those that distinguished peaches "from Calanda area with PDO" of peaches "from Calanda area without PDO". The parameters of "from Calanda area with PDO represent 48.6% of total parameters while largest size peaches represents only 2.2%.

Table 6.3 Number of consumers, per attribute-level, that considered one or two attributes-levels on their choice decision, at 10% of p-value

Attributes	Attributes-levels	Number of betas			Total
		1 beta	2 betas	Total	(%)
Price	Low price - 1.5 €/kg (β_1)	4	16	20	7.1
	High price - 3.5 €/kg (β_2)	13	16	29	10.4
Origin	From Calanda area with PDO (β_3)	88	48	136	48.6
	From other area without PDO (β_4)	15	48	63	22.5
Packing	Bulk peaches (β_5)	2	3	5	1.8
	Active packing (β_6)	8	3	11	3.9
Peach size	Smallest (β_7)	6	3	9	3.2
	Largest (β_8)	4	3	7	2.5
Nº of statistical significant betas		140	140	280	100
Nº of consumers		140	70	210	100
% of sample		44.2	22.2	66.4	-

Table 6.4 describes the preferences of consumers that considered one attribute-level when buying. Given that 140 consumers (44.2% of total consumers) differentiated only one level of attribute, this analysis is made explanatorily. In total, 102 consumers (32.3% of sampled consumers) have utility, i.e., they would like to change the attribute-level of reference for the other attribute-level, and 38 consumers (12.0%) have disutility, i.e., they prefer the attribute-level of reference. It total, there are 88 consumers, or 27.8% of total consumers, have positive utility with peaches "from Calanda area with PDO". Those consumers decided their buying considering only the

PDO Calanda peaches brand. For them, where peaches are produced is not important because they are indifferent between peaches from Calanda area without PDO and from other area without PDO. This kind of consumers can be known as "brand buyers".

It is found also that 15 consumers, 4.7% of total consumers, distinguish only peaches "from other area without PDO" from peaches "from Calanda area without PDO". All those consumers have negative utility with peaches produced in other area without PDO. For this kind of consumer, the place where peaches were produced is very important but they are indifferent if peaches have or not PDO Calanda peaches' brand. They can be named as "production area buyers".

Table 6.4 Utility and disutility of each attribute-level in IUF with one parameter statistically significant, at 10% of p-value

Attribute	Attribute-level	Number of betas			Total
		Utility	Disutility	Total	(%)
Price	1.5 €/kg (β_1)	3	1	4	2.9
	3.5 €/kg (β_2)	4	9	13	9.3
Origin	From Calanda area with PDO (β_3)	88	0	88	62.9
	From other area without PDO (β_4)	0	15	15	10.7
Packing	Bulk peaches (β_5)	1	1	2	1.4
	Active packing (β_6)	2	6	8	5.7
Size	Smallest (β_7)	0	6	6	4.3
	Largest (β_8)	4	0	4	2.9
Nº of statistical significant betas		102	38	140	100.0
Nº of consumers		102	38	140	100.0
% of sample		32.2	12.0	44.2	-

Concerning price, high price (3.5€/kg) as well as low price (1.5) can give positive or negative utility to consumers. For 13 consumers who differentiated high price from medium price (2.5€/kg), 30.8% have positive and 69.2% negative utility when price move from 2.5€/kg to 3.5€/kg. In both cases, those consumers are indifferent between 2.5€/kg and 1.5€/kg. Consumers that only have utility with high prices do not break the basic rational economic concept. This consumer tends to adopt this behaviour when there is a lack of information, so price becomes a quality cue; in our case, all other characteristics could not give enough information on peach quality perception. Thus, this type of consumers can be related as "high price buyers". It is also found that 9 consumers that only have disutility with high price, i.e., they only avoid high price, thus they are named as "high prices non-buyers".

Low price gives disutility to one consumer in the sample and this person is indifferent between medium and high price. She is named as "low price non-buyer". Similarly to "high price buyers", "low price non-buyers" think that product quality increases when price increases. However, "high price buyers" believe peaches quality is low when price is less or equal to 2.5€/kg while "low price non-buyers" think that peaches only have low quality when it costs 1.5€/kg.

The other consumers that considered low price have utility with it. It means that these 3 consumers consider low price as a good opportunity to purchase. Since October 6th, peaches prices in Carrefour varied between 2.0 to 2.5€/kg (Graphic 2.3 – Chapter 2), so they could consider that 1.5€/kg was an unavailable price in the market and then low price influenced them to purchase peaches. This kind of consumer can be considered as "low price buyers".

Results also show that there are a greater number of consumers (9 consumers) that have disutility (4 consumers) with high price and more consumers have utility with low price than disutility (3 consumers). It indicated that a greater part of consumers consider price as a factor to save money and fewer consider it as a quality cue.

In relation to packing, it was found that one person has negative and another has positive marginal utility with bulk peaches. Thus, the first person prefers packing over bulk peaches and he is indifferent if packing is normal or active. He can be considered as "packing buyer". The other consumer prefers bulk peaches over normal packing and he is also indifferent if packing is normal or active, i.e., he refuses any kind of packing, then he can be know as "non-packing buyer". Table 6.4 also shows that 2 consumers have disutility when it is changed a normal packing for an active packing and they are also indifferent between normal packing and bulk peaches. Consumers with this preference believe that treatment, which allows storing peaches for a longer time, it decreases the peach quality even known that it neither would change the taste nor would have negative consequences to health. They are called her as "non-active packing buyers".

It was also detected that 6 consumers have positive utility with active packing. They are indifferent between normal packing and bulk peaches. Thus, they feel only the benefits with the possibility of storaging peaches for longer time. In our analysis they are called as "active packing buyers".

In relation to packing and non-packing buyers, more consumers could be included as active and non-active packing buyers. This result can be explained by the availability of active packing in the market. As it is a new product, it can attract more attention (positively or negatively) of consumers than normal packing, which is still available in the market.

In total, 10 consumers have chosen late season peaches by its size. Sixty percent of them have disutility when change the same amount of medium size (250g) to smallest size (160g) peaches and they are indifferent between medium and largest size (380g). They are classified here as "non-smallest size buyers". On the other hand, "largest size buyers", are those consumers (there are 4 consumers with this profile in the sample) that have only positive utility with largest size and they are indifferent between smaller peaches.

As pointed earlier (table 6.3), 70 consumers considered two attribute-level on their choice decision, thus it generates 140 parameters (betas) statistically different from zero. Table 6.5 describes the basic structure of Individual Utility Functions with two parameters statistically different from zero. This table points that all consumers who distinguished two attributes-levels considered that all levels of a same attribute are different. For example, all low prices' betas share the same IUFs with all high price betas and they do not share the same IUF with other attribute-levels else. The same occurs for origins, packing and peach sizes levels. Therefore, 16 consumers considered prices, 48 origins, 3 packing and 3 peaches sizes on their purchase.

Table 6.5 also provides information to study the utilities and disutilities in IUF with two parameters statistically different from zero easier. The total number of pairs of combination, of considering different signs (utility and disutility), between 8 parameters from 4 attributes are 112. However, the previous knowledge than one pair of attribute-level can be just combined within attribute, the number of combination is reduced to 16 (4 for each attribute).

Table 6.5 Basic structure of IUF with two parameters different from zero, at 10% of p-value

Attributes	Attributes' levels	Price		Origin		Packing		Size		Total
		β_1	β_2	β_3	β_4	β_5	β_6	β_7	β_8	
Price	Low price - 1.5 €/kg (β_1)	-	16	0	0	0	0	0	0	16
	High price - 3.5 €/kg (β_2)	16	-	0	0	0	0	0	0	16
Origin	From Calanda area with PDO (β_3)	0	0	-	48	0	0	0	0	48
	From other area without PDO (β_4)	0	0	48	-	0	0	0	0	48
Packing	Bulk peaches (β_5)	0	0	0	0	-	3	0	0	3
	Active packing (β_6)	0	0	0	0	3	-	0	0	3
Size	Smallest size (β_7)	0	0	0	0	0	0	-	3	3
	Largest size (β_8)	0	0	0	0	0	0	3	-	3
Nº of statistical significant betas		16	16	48	48	3	3	3	3	140
Nº of consumers		16		48		3		3		70
% of sample		5.1		15.2		0.9		0.9		22.2

Table 6.6 shows the number of consumers (of IUF) that have particular combinations of utility and/or disutility (positive and/or negative sign) between levels (parameters or betas) of the same attribute. It is possible to see that, for example, all consumers who considered origin levels on their choices only have utility when shift peaches "from Calanda area without PDO" from peaches "from Calanda area with PDO" and negative utility if peaches "from Calanda area without PDO" from peaches "from other area without PDO". It shows that those consumers not only want peaches produced in Calanda area but they also prefer certified peaches by the Regulatory Council. Those consumers can be considered as "production area and brand buyers".

Following the same classification system, it was found that there are 3 consumers who are "packing but non-active packing buyers", who are consumers with preferences for normal packing, but refuse active packing. In relation to peaches sizes, other 3 consumers that are "non-smallest and largest size buyers",i.e., they prefer medium size peaches over smallest size and largest size over medium size. For them, any improvement in peach size increases the product's utility.

Table 6.6 Number of IUF according with different betas signs combinations within attribute, at 10% of t-probability

Attribute	$\beta_n>0$ and $\beta_{n+1}>0$	$\beta_n>0$ and $\beta_{n+1}<0$	$\beta_n<0$ and $\beta_{n+1}>0$	$\beta_n<0$ and $\beta_{n+1}<0$	Total
Price	0	14	2	0	16
Origin	0	48	0	0	48
Packing	0	3	0	0	3
Size	0	0	3	0	3

Note: β_n for price is low price and β_{n+1} is high price; β_n for origin is from Calanda area with PDO and β_{n+1} is from other area without PDO; β_n for packing is peaches in bulk and β_{n+1} is active packing; and β_n for size is small size and β_{n+1} is largest size.

All prices levels were taking into account for 16 consumers. Most of them have utility and disutility with low and high prices, respectively, at same time. This group of consumers is the most sensitive to price because all price levels are important for them. So, they can be named as "non-high and low price buyers". It was also found that there are 2 consumers who have the opposite behaviour and they can be considered as "non-low and high price buyers". The difference between this last group and consumers from "high price buyers" is that "high price buyers" consider that peaches of 1.5€/kg and 2.5€/kg have the same low quality while "non-low and high price buyers" believe that peaches sold for 1.5€/kg have lower quality than peaches sold for 2.5€/kg.

6.A) Origin Sensitive Consumers and Other Groups

This section is dedicated to study the differences within "Origin Sensitive Consumers" (group 1) and the differences between this group and other groups of consumers. In this analysis, it is considered that origin sensitive group is formed by 3 subgroups of consumers: "Brand buyers" (subgroup 1) with consumers that only have utility with PDO Calanda peaches brand and it has 88 consumers; "Production area buyers" (subgroup 2), with consumers that only have utility when peaches are produced in the Calanda area and it has 15 consumers; and finally, the "Production area and brand buyers" (subgroup3), with consumers that have positive utility with peaches produced in the Calanda area as well as they have positive utility if peaches are certified for PDO Calanda peaches brand, and there are 48 consumers. In total, these three subgroups of consumers, which set up the origin sensitive group, have together 151 consumers, which represents 48.8% of the total sample.

Two other kinds of consumers are also considered other in this analysis. One kind is the "Other Attribute-level Sensitive Consumers" (group 2) that is defined as those consumers who distinguished, with exception of origins-levels, at least one attribute-level on their decisions. This group has 59 consumers (210 – 151). The third type of consumers is called "Attribute-level Indifferent Consumers" (group 3). This kind of consumer is indifferent between all attributes-levels and they can be enumerated as those IUF without any parameter statistically different from zero, at 10% of p-value. It includes 106 (316 – 210) consumers.

6.A.1) Differences between origin sensitive group and other groups

The three groups of consumers are compared in relation to how important are the PDO Calanda peaches attributes for each group, the attitudes toward PDO Calanda peaches and their socio-demographic characteristics. The attributes importance was measured by the Best-Worst score (the survey elaboration is described with more detail in Chapter 4). The Best-Worst Score (BWS) is the difference between the number of times that one attribute was selected as the most important and the number of times that it was selected as the least important attribute that influence consumer purchase decision. First it was estimated the BWS for all consumers, then it was compared the consumers' BWS from different origin sensitive subgroups by U of Mann-Whitney test. Those attributes that have different importance between subgroups are listed in the Table 6.7.

Comparisons between differences in importance of 10 attributes are listed in the Table 4.1 (Chapter 4) and it was found significant differences in 4 attributes. Consumers from group 2 give more importance to price (BWS = 0.8) and less importance to smell (BWS = 0.5) than consumers from groups 1 and 3, and they consider taste less important (BWS = 2.5) than consumers from group 3 (BWS = 2.8). Consumers from group 1 are differentiated from those from group 3 only for bag production. Although both groups mentioned more often that bag production is the least important attribute than the most important when they buy peaches, consumers who discriminate origins-levels give more importance to this attribute than those that were indifferent between attributes-levels at 10% of p-value.

Table 6.7 Different attribute importance between Origin Sensitive Consumers and other kind of consumers

	Group 1 x Group 2	Group 1 x Group 3	Group 2 x Group 3
Taste			(2.5 x 2.8)*
Price	(0.0 x 0.8)**		(0.8 x 0.2)*
Bag production		(-0.5 x -1.0)***	
Smell	(0.8 x 0.5)*		(0.5 x 0.8)*

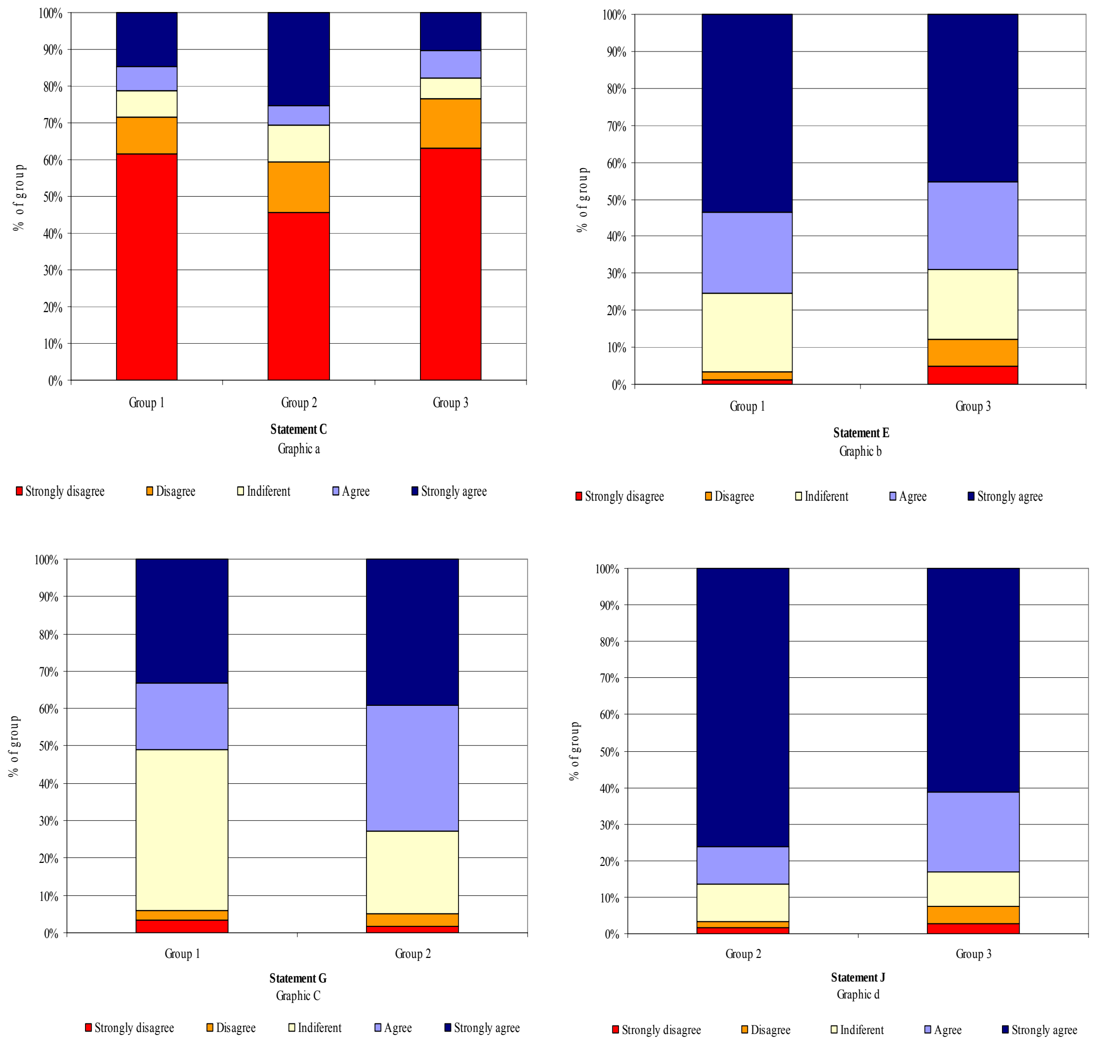
Note: The symbol (*) represents parameter is statistically significant at 10% of p-value, (**) at 5% and (***) at 1%.

Comparisons were made between the answers provided by the three kind of consumers (group 1, 2 and 3) about statements made in question 8 (see appendix 1 – survey 2008). Question 8 has 10 statements and consumers declared their agreement degree with each statement by a Likert scale. They pointed out 1 if they strongly disagreed with the statement and 5 if they strongly agreed. The responses from these three origin sensitive subgroups, of each statement, were compared using the U of Mann-Whitney test.

Significant differences were found in agreement in relation to statement “C” (Graphic 6.5.a), “E” (Graphic 6.5.b), “G” (Graphic 6.5.c) and “J” (Graphic 6.5.d). Statement “C” is “if all consumers wear gloves, I still feel hesitate to buy touched peaches”; while statement “E” is “when I buy PDO Calanda peaches I know that the environmental quality in the production area will improve because they use cleaner production techniques”; statement “G” is “PDO Calanda Peaches are more nutritive than other peaches”; and statement “J” is “if they had the same quality, I would like to buy PDO Calanda peaches during November and December”.

Consumers from group 2 agree more than those from groups 1 and 3 that they dislike when other consumers to touch peaches, although everybody wear gloves. It can be understood that these consumers are more worried with possible injuries than other consumers. They also have stronger preference for extending PDO Calanda peaches offer during November and December than consumers from group 3. Consumers from group 1 have an intermediate opinion about extending PDO Calanda peaches offer because it was not found significant differences of their statement agreement with other groups.

Graphic 6.5 Different agreement degree between two origin sensitive subgroups about their habit of eating peaches



Note: Group 2 differ in relation to groups 1 and 3 about statement "C" at 5% of p-value; regarding to statement "E" the difference between group 1 and 3 is statistically significant at 10% of p-value; group 1 differ in relation to statement "G" of group 2 at 5% of p-value; and groups 2 and 3 differ at 10% of p-value about statement "J".

Consumers sensible with origin, from group 1, have a stronger point of view of PDO Calanda peaches production system is more environmentally friendly than consumers from group 3. These two groups also differ in relation to bag production importance. This finding is relevant because it shows that consumers from group 1 have better knowledge about PDO Calanda peaches production system benefits than those consumers that are indifferent with peaches characteristics.

Origin sensitive consumers have different opinion about nutritive value of PDO Calanda peaches than consumers from group 2. Although consumers from group 2 perceive PDO Calanda peaches as more nutritive than other kind of peaches, they do not distinguish this characteristic on their buying decisions. This particular result points out that the peach nutritional value may not change consumers buying decisions.

The last comparisons were undertaken in relation to consumers' socio-demographic characteristics and for some consumers' attitudes toward PDO Calanda peaches. For that reason, the Chi-square test have been calculated for variables, such as: PDO Calanda peaches frequency, considering regular and sporadic consumers; largest PDO Calanda peaches consumption strategy, where consumers were divided in those that only share, only eat it once, only eat it later at several periods of time, other strategies and if sometimes employ two eating approaches; the main place store PDO Clanda peaches, such as refrigerators, fruit bowls and other places; loyalty degree, if consumers would or would not buy other stone fruit if PDO Calanda peaches were available in the market, and no high loyalty degree, that are those consumers who would buy any stone fruit if PDO Calanda peaches would not be available in the market; main place of purchase PDO Calanda peaches, whether they were in the markets, fruit store, super/hypermarkets, or other places; consumers' age, whether they were older or younger than 50 years old; gender; education level, in elementary or other (high school or college) education level; presence or absence or children in the household; presence or absence of teenages in the household; household income, whether they had higher or lower income than 1,500€/month; and consumers' activity, if they were dedicated full time at home, full time outside home and partially work outside home. The statistic chi-square of Pearson was calculated considering the three groups. When the null hypothesis was accepted it indicated that there were not significant differences among variables from different groups of consumers.

Results shown in the Table 6.8 indicate that only there exist differences in education level. Those consumers who perceive differences on peaches quality, from groups 1 and 2, have less education level (around of 30% of them have elementary education) than those consumers who are indifferent with peaches characteristics (near of 20% of them have elementary education).

Table 6.8 Differences of elementary education level between origin sensitive and other groups

	Elementary Education level(*)	
	Nº	%
Group 1	48	31.8
Group 2	18	30.5
Group 3	21	19.8

Note: (*) represents parameter is statistically significant at 10% of p-value

6.A.2) Differences within origin sensitive group

The aim of this section is to detect if there are differences among the three origin sensitive subgroups in relation to PDO Calanda peaches attributes importance, the attitudes toward PDO Calanda peaches and their socio-demographic characteristics. The employed method is the same than in section 6.A.1. However, given the number of studied people, this analizes can be considered as an exploratory analysis and results should be interpreted with caution. Those attributes that have different importance among subgroups are listed in the Table 6.9.

Table 6.9 Different attribute importance within origin sensitive group

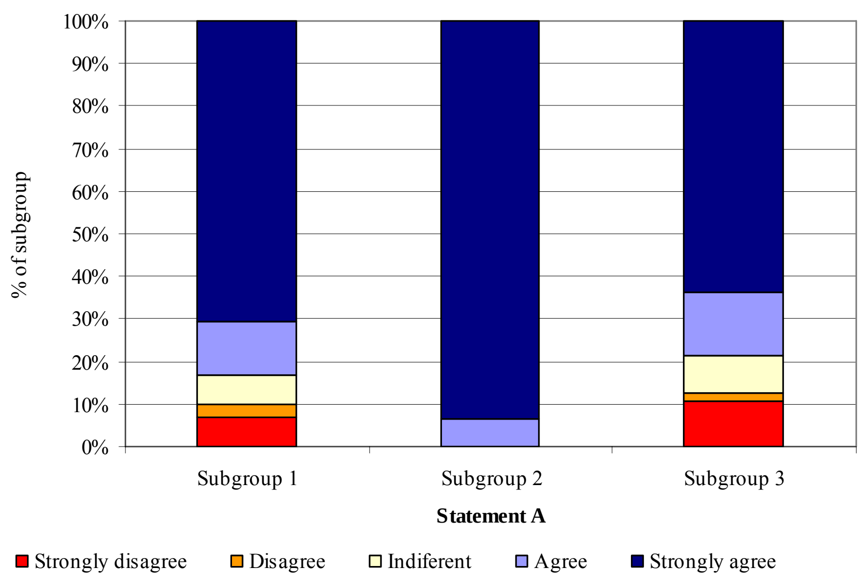
	Subgroup 1 x Subgroup 2	Subgroup 1 x Subgroup 3	Subgroup 2 x Subgroup 3
Price		(0.2 x -0.3)*	
Smell		(0.7 x 1.1)*	(0.5 x 1.1)*
Packing	(-2.1 x -3.0)**		
Ripeness			(2.3 x 1.6)*

Note: The symbol (*) represents parameter is statistically significant at 10% of p-value and (**) at 5%.

Consumers that consider brand as well as production area on their purchase (subgroup 3) give less importance to price than those consumers that consider only brand (subgroup 1), they consider ripeness less important than consumers from subgroup 2, and they give more importance to smell than any other subgroup of consumer. Beside the listed differences, consumers from subgroup 1 give more importance to packing than those from subgroup 2.

As a result from statements of question 8th, differences in agreement degree statistically significant between subgroup 2 and others subgroups about the statement a) were found (Graphic 6.6). This statement measures the consumers' habit of eating peaches since their childhood. A great proportion of consumers strongly agree that they consumed peaches since their childhood. Consumers from subgroup 1 and 3 have similar habit and around of 10% of them mentioned that did not eat peaches since their childhood. However, consumers from subgroup 2, which are characterized by their utility related to the place where peaches were produced, whether in the Calanda area and by their indifference if peaches have or not PDO brand, only strongly agree or agree with the statement. This result shows that consumers who did eat or eat few peaches in their childhood have more utility with PDO Calanda peaches' brand.

Graphic 6.6 Different agreement degree between two origin sensitive subgroups about their habit of eating peaches



Subgroups have different profiles in relation to household income and main place of PDO Calanda peaches purchase (Table 6.10). Consumers from subgroup 2 have higher income than others because only 6.7% of them have low household income (less than 1,500€/month) while this percentage for other consumers vary from 30% to 45%. Those consumers also attend more often fruit stores to buy PDO Calanda peaches than others. Other consumers buy mostly PDO Calanda peaches in super/hypermarkets and fruit stores are the second most attended place for them. Consumers from group 1 are different from others because they buy peaches in markets and other places whereas others do not buy in these places.

Table 6.10 Differences of socio-demographic characteristics between origin sensitive subgroups

	Subgroup 1		Subgroup 2		Subgroup 3	
	Nº	%	Nº	%	Nº	%
Household income (**)						
Less than 1,500€/month	39	44.3	1	6.7	15	31.3
Main place of PDO Calanda peaches purchase (**)						
Markets	18	20.5	0	0.0	6	12.5
Fruit stores	21	23.9	9	60.0	18	37.5
Super/hypermarkets	44	50.0	6	40.0	24	50.0
Others	5	5.7	0	0.0	0	0.0
Total	88	100.0	15	100.0	48	100.0

Note: The symbol (**) represents parameter is statistically significant at 5% of p-value.

6.4 Final remarks

The main theoretical advantage of estimating utility functions for each subject is that it is not necessary to make assumptions about preferences distribution across sampled consumers. For unbiased estimations at sample level, the preferences (measured by betas) should be normally distributed and not correlated. In our case, parameters are not normally distributed. The parameters from both origins-levels (peaches from Calanda area with PDO and from other area without PDO) are very far from normal distribution, meaning that estimations at sample levels can be biased (it breaks the models' assumption).

At individual level, the Bottom-up model had the greatest performance. It was the only model that could estimate parameters (68 betas) statistically different from zero at 1% of p-value. At 5% of p-value, it estimated almost 3.2 times more parameters than the second best model (Simultaneous BW) and at 10% of p-value this difference was 1.52 times (52% more parameters). When models were compared at individual level it was also detected that the number parameters (betas) statistically different from zero, at different p-values, has positive relationship with the number of choices per respondent and with the number of alternatives in the choice set.

In the analysis of individual preferences, beta statistically equal to zero (when the null hypothesis is accepted) means that consumers are indifferent between the attribute-level of reference and the attribute-level of the estimated parameter and otherwise when parameter is different from zero. Graphics 6.4 and 6.5 show that the number of statistically significant betas is sensible to p-values (accuracy) of those betas. When a more accurate condition is imposed (for example, considering the preferences at 1% of p-value) more consumers get indifferent between attribute-levels and the individual preferences also become simple (they distinguished only one attribute-level). Considering 10% of p-value, although the accuracy decreases (this accuracy level is still assumed in many empirical studies) less consumers are indifferent with attributes-levels and the structure of Individual Utility Functions (IUF) become more complex and they have richer preferences interactions.

At 10% of p-value, almost 1/3 of consumers are indifferent with attribute-levels and 44.2% distinguish one attribute level and the rest of the consumers differentiate two attributes-levels on their choice decision. From those consumers who consider at least one characteristic of late season peach on their decision, almost 50% have differentiated peaches from Calanda area without PDO from peaches produced in Calanda area but without PDO, whereas only 1.8% of those consumers have distinguished bulk peaches from peaches sold in normal packing.

In relation to peaches produced in Calanda area without PDO, peaches from Calanda area with PDO only provide utility to consumers while those from other area without PDO only give negative utility. It means that consumers value the PDO brand

and the production area "from Calanda" positively. Consumers have also shown consensus in relation to peach size. For example, changing from medium size peach to smallest size always caused disutility and changing from medium size to largest size always give positive utility to consumers. In the case of price and packing types, for example, it was found that some consumers have positive utility with low price (1.5€/kg) and others have negative utility and the same happens with high price (3.5€/kg).

The structures of IUF have also revealed that those consumers who differentiated 2 attributes-levels, always differentiate the levels from the same attribute. They had utility with one attribute-level and disutility with other attribute-level.

Hence, in the analysis, it was possible to classify consumers according to their evaluation within and between attributes. Between attributes, consumers could be classified as "origin-sensitive", "other attribute-level sensitive" and "attribute-level indifferent". Consumers from the fist group valued at least one origin-level whereas consumers from the "other attribute-level sensitive" group are those that considered any other attribute-level than not origin-level on their choice and consumers from "attribute-level indifferent" are those that were indifferent among attribute-levels (their IUF had not any beta statistically different from zero).

The origin sensitive group represents 48.8% of sampled consumers and, in relation to other groups, consumers from this group give more importance to bag production than those consumers from "attribute-level indifferent" and they give less importance to price and more to smell than consumers from "other attribute-level". Consumers from the "origin-sensitive" group think that PDO Calanda peaches are produced with friendlier environment measures than other peaches and they do not believe that PDO Calanda peaches are more nutritive than others, which reflect a better knowledge about the product than other consumers.

Consumers from the origin-sensitive group were divided in three sub-groups. One is called as "brand buyers", cluster those consumers that only distinguish peaches "from Calanda area with PDO" to those "from Calanda area without PDO" but they are indifferent between peaches "from Calanda area without PDO" and "from other area without PDO". The second sub-group is named "production area buyers" and consumers that belong to this sub-group distinguish peaches "from Calanda area without PDO" to "from other area without PDO" and are indifferent between other origins levels. The last sub-group named as "production area and brand buyers" joint all consumers that distinguish all origins-levels. The first sub-group is the larger and the second the smallest.

Within origin-sensitive groups, consumers from "production area and brand buyers" are those who give less importance to price and to ripeness of PDO Calanda peaches when they purchase them, however, they consider smell as very important. The difference between "brand buyers" and "production area buyers" is that the first sub-group gives significantly more importance to packing than the second, i.e., those who are willing-to-pay more for brand also consider more the product presentation in the shelf. While a greater proportion of consumers from "brand buyers" consume peaches since their childhood they purchase more often PDO Calanda peaches in markets, consumers from "production area buyers" have higher income and it may affect where they buy peaches because more often they purchase in fruit stores and they attend neither markets nor other places.

Chapter 7: The overall significance of attributes and attributes’ levels on late season peaches consumers’ choice

7.1 Introduction

Discrete Choice Experiments (DCE) are commonly used to studying preferences. This method provides information about potential, demand shifts, market shares for alternative prices and for new products among other uses, for marketing purposes. This kind of experiment is very simple; basically, a set of options are offered to respondents, then they compare the option according to their preferences and they make decisions about statements. Traditionally, the statement corresponds to the best option, that is, the alternative which maximizes the consumer's utility.

The most popular choice experiment is the multi-attribute. In the Multi-Attribute Choice Experiment (MACE) each alternative corresponds to a hypothetical product (some authors call hypothetical products as profiles). Hypothetical products are built from different combination of attributes-levels. In our work an attribute-level is a level of an attribute. For example, if the attribute is the colour, its level may be red, green, yellow, etc.

The aim of a MACE is to measure the marginal utility that consumers have with attributes-levels. The main limitation of a MACE is that it is not possible to measure the importance or the impacts that the attribute has on consumers' decisions. According to Flynn *et al.* (2007) when a particular or all levels from an attribute are not statistically different from zero (it means zero utility), it means that consumers do not distinguish the attribute-level from the reference attribute-level, but it does not mean that this attribute is not important for consumers purchase decision.

In order to solve this limitation, attributes impacts and attributes-levels utilities must be measured in a common scale. The attribute-level maxdiff choice experiment (ALMCE) makes this common scale measurement possible. This experiment is based on a Best-Worst Choice Experiment (BWCE). In the BWCE respondents are asked to state the best (or the most important) and the worst (or the least important) alternatives. ALMCE has been formally developed recently by Marley *et al.* (2008) and until now few works (Coast *et al.*, 2006; Lancsar *et al.*, 2007; Flynn *et al.*, 2007; Flynn *et al.*, 2008a) have dealt with this method.

The aim of this chapter is to study PDO Calanda peaches consumers' preferences taking into consideration the attributes impact and the attributes-levels utilities of late season peaches in Zaragoza city. This experiment provides a complementary analysis for the PDO Calanda peaches' attributes impact estimations (Chapter 4) and for late season peaches utilities estimations (chapter 5 and 6).

Only the Flynn *et al.* (2008a) have dealt with consumers' heterogeneity on attribute and attributes-levels preferences. They estimate the interactions between health care services and patients' characteristics. However, until now the heterogeneity on consumers' preferences for attributes and attributes-levels, measured in the same scale, were not contrasted with Mixed Logit models (MXL). Thus, the other objective of this chapter is to detect the heterogeneity of preferences for late season peaches' attributes and attribute-levels in order to explain the variability according to consumers' characteristics.

For this porpose, the chapter is organized as follows: First, the theoretical background of an attribute-level maxdiff choice experiment and the experimental design are described in sections 2.1, 2.2 and 2.3; then, first estimations of late season peaches' attributes impacts and attributes-levels utilities for a homogeneous market are presented; later on a Mixed Logit model is proposed for the ALMCE and in section 3.2 characteristics have heterogeneity on consumers preferences are detected; once detected the heterogeneities, they are explained in section 3.3; and finally, section 4 summarizes the main findings and some suggestions are offered for the peaches industry and for future works dealing with the method.

7.2.1 Attributes' impacts and attributes-levels' utilities

Conjoint Analysis (CA) estimates the rate at which subjects are willing to trade off between two attribute levels. If the null hypothesis is accepted, it means that the preference weight for one level of an attribute is not statistically significant different from the preference weight for a different level of the same attribute. However, if the hull hypothesis is rejected, subjects are not willing to trade one attribute level for other level of the same attribute without compensation.

Flynn *et al.* (2007) affirm that in many studies there are misinterpretations of CA results. Often analysts conclude that a particular attribute is unimportant on consumers when all levels from this attribute are not statistically significant. The correct interpretation is that consumers do not distinguish among the considered levels of this attribute, but it is not possible to make any inference about the attribute impact. These authors called this misinterpretation as scale confounding and they gave an example to illustrate what means an attribute impact and an attribute-level utility. In our example is simplified to hypothetical peaches with two attributes. Each attribute has two levels with different scale value (Table 7.1). The parameters in this table present preferences from one person or from one market with same preferences.

Table 7.1 Scale value of each attributes level and attributes impacts on utility

Attribute		Scale value of each attribute level		
	Impact	Constant	Level 1	Level 2
Size	0.2	0.1	0.4	0.9
Packaging	0.8	0.5	0.2	0.5

Note: Level 1 for size can be, for example, small size, and big size for level 2; and level 1 for packaging is fruits in bulk and fruits in tray for level 2.

Table 7.2 shows how to calculate the total utility of hypothetical peaches based on the information in table 7.1. Two attributes, with two levels each one, produce 4 (2^k) combinations of attributes-levels or hypothetical products. Thus, for example, to calculate the total utility of peach 1 (a small size peach that is sold in bulk), first it is necessary to estimate the scale from each attribute-level (for size is 0.1 + 0.4 = 0.5; and for packaging is 0.5 + 0.2 = 0.7) and then the scale is multiplied for the correspondent attribute impact (for size is 0.5 * 0.2 = 0.1; and for packaging is 0.7 * 0.8 = 0.56) to get the utility of this characteristic. Finally, as the considered model is lineal and additive, the total utility is obtained just summing the results of the last multiplication (0.1 + 0.56 = 0.66).

According to Lancsar *et al.* (2007) estimations from Discrete Choice Experiment data (multi-attribute), measure the marginal utility between two levels of the same attribute, thus in our example the marginal utility of size, it is the difference between the utility of a largest size peach [0.2 = (0.1 + 0.9)*0.2] and small size peach [0.1 = (0.1 + 0.4)*0.2], is 0.1 and 0.24 for packaging (estimated by 0.8 – 0.56). In such analysis, the weight of attributes impacts and the level scale values of attribute level's utilities are not separated. To separate them it is necessary to measure the attributes and attributes-levels with a common ratio scale (Marley, 2009; Lancsar *et al.*, 2007).

Table 7.2 Estimated utilities for different hypothetical peaches

		Hypothetical peaches			
		1	2	3	4
Characteristic	Size	0	1	0	1
	Packing	0	0	1	1
Scale	Size	0.50	1.00	0.50	1.00
	Packing	0.70	0.70	1.00	1.00
Scale x impact	Size	0.10	0.20	0.10	0.20
	Packing	0.56	0.56	0.80	0.80
	Total utility	0.66	0.76	0.90	1.00

Note: For size, if attribute level = 0 it means that fruit is small and otherwise it is big. For packaging, if attribute level = 0 it means that that fruit is in bulk and if attribute level is = 1 it is conditioned in trays.

Darian *et al.* (2005) measured the relative importance of attributes and attributes-levels utilities in a common scale. They have shown different profiles to consumers and asked them to rate every attributes-level of the profiles according to its importance on their choice decisions. They have found high percentages of consumers that rated the attributes-levels as very important on their decision. Their results show for this kind of experiment the rating weakness of scale uses bias and, probably, the lack of trade-off between alternatives. Thus, attribute-level maxdiff can represent a solution to measure the attribute and attribute-level measurement and at same time it solves the problem of rating tasks.

7.2.2 Attribute-level maxdiff model

In the 90's, Finn and Louviere (1992) proposed a discrete choice task with which subjects state the best (or most important) and the worst (or least important) alternatives in an available (sub) set of choice alternatives with more than three options. At the beginning, this new method was designed to measure the relative importance of attributes. However, the method has been developed and nowadays it is used in different experiments, such as: attribute-level maxdiff models or attribute-level best-worst choice.

Attribute-level maxdiff models evolve several profiles with attributes-levels. The term "attribute-level" is used for a specific level of an attribute. Each profile represents a hypothetical product and it is built from different combination of attributes-levels. It is assumed that consumers make choices within profiles, i.e., each profile is a choice set. Table 7.3 shows an example of a profile, from Chrzan (2005) studying task, where consumers had to state the features that would make them most wanted to buy the TV and which would make them least wanted to buy it. Note that once the decision is made, the most as well as the least important alternative, it states the attribute and its respective level.

Table 7.3 An example of attribute-level maxdiff task

Profile	Most	Least
Built-in DVD player: No	[ ]	[ ]
Flat screen: No	[ ]	[ ]
Cable-ready: Yes	[ ]	[ ]
Warranty: 5 years	[ ]	[ ]
Manufacture: Sony	[ ]	[ ]
Price: $299	[ ]	[ ]

Source: Chrzan (2005)

To understand how the importance and the utility of each an attribute might be measured separately, it is necessary a clear formulation of the mathematical properties of attribute based model of best, worst and best-worst choices (Marley *et al.*, 2008). Thus, let X, $|X| = n \geq 2$, denote a typical available choice set. Where, $x, y \in X$, $BW_X(x, y)$ denotes the probability that x is chosen as best in X and $y \neq x$ is chosen as worst in X. We have, $0 \leq BW_X(x, y) \leq 1$ and $\sum_{x,y \in X, x \neq y} BW_X(x, y) = 1$. It is obtained a set of best-worst choice probabilities (on a master set T) when there is a set of best-worst choice probabilities on some of the X, $X \subseteq T$; the set of choice probabilities is complete when there are choice probabilities on all $X \subseteq T, |X| \geq 2$.

The above notation is sufficient for best-worst scaling estimation, however for attribute-level estimation it is necessary to extend. It is assumed that there are m attributes, usually with $m \geq 2$, and let $M = \{1,...,m\}$. Attribute *i*, $i = 1,...,m$, has $q(i)$ levels, then let $Q(i) = \{1,...,q(i)\}$ be the set of all levels of attribute *i*. A profile is an m-component vector with each component *i* taking on one of the $q(i)$ levels for that component. Thus, there is a set of size $\prod_{i=1}^{m} q(i)$ of possible profiles; this set is denoted as Q. Let $D(P)$, $P \in Q$, denote the design, i.e., the set of (sub) sets of profiles. The typical profile is denoted as equation 7.1.

$$z = (z_1,...,z_n) \qquad 7.1$$

Where $z_i, i = 1,...,m$, denotes the level of attribute *i* in profile z. Each z_i is called as an attribute-level. For a single profile $P \in D(P)$, $P \in Q$ is presented and subject selects the best and the worst attribute-level in that profile. Thus, $BW_X(x, y)$ becomes: for $z \in D(P)$, $P \in Q$, and $\{i, j\} \in M$, $i \neq j$, $BW_z(z_i, z_j)$ is the probability that attribute-level *i* and *j* is chosen and best and worst alternatives, respectively. We have also $0 \leq BW_z(z_i, z_j) \leq 1$ and $\sum_{i,j \in M, i \neq j} BW_z(z_i, z_j) = 1$. If there is a positive a ratio scale b on the attributes, a set of best-worst probability on P satisfies the attribute-level maxdiff model is given by equation 7.2 (Marley and Pihlens, 2010):

$$BW_z(z_i, z_j) = \frac{b(z_i) / b(z_j)}{\sum_{\substack{k,l \in M \\ k \neq l}} b(z_k) / b(z_l)} \quad (i \neq j) \qquad 7.2$$

Although this kind of task seems to be unusual, in previous studies yielded reliable interpretable data. Probably, Coast *et al.* (2006) have used first the attribute-level maxdiff method by studying patients' preferences for dermatology secondary care services. They estimate the attributes impact of care as well as their respective utilities values for each level of each attribute. The estimated attributes impacts are not the same than the attributes importance, which have been investigated by psychologists (Flynn *et al.*, 2008a). Nevertheless, knowledge about attributes' overall impacts is useful because it helps policy makers to decide which key attribute should have improved levels.

Dorow *et al.* (2009) have used the attribute-level maxdiff model to separate the weight (importance) given by the stakeholders to a particular management action or policy of scale (importance) given to variation within each management action or policy. For them, this method allows to understand if stakeholders objectives follow a management approach or merely to the degree to which that approach is implemented, while other stated methods can not achieve this result.

7.2.2.1 Attribute-level maxdiff approaches

It is possible to analyse attribute-level maxdiff data at sample level (or aggregated estimations) by the Weight Least Squares (WLS) model and, at individual level, employing the Multinomial Logit (MNL) model. In both models, Paired and Marginal approaches can be used (Flynn *et al.,* 2007). On the Paired analysis approach it is considered that respondents compare all available pair of alternatives in the choice set and they select a pair with maximum utility difference. The Paired analysis model takes into account that the subject makes only one decision per choice set, he chooses that pair of alternatives that maximize the utility difference and also states the best and the worst option (thus, for example, the subject chooses one pair of alternatives among the following pairs of alternative combination: (A, -B), (A, -C), (B, -A), (C, -A), (B, -C) and (C, -B). In this case the number of alternatives per choice set increases.

The second approach is the Marginal analysis, which assumes that consumers make two choices simultaneously in a set of available alternatives of size M; and one choice is the best (or the most important) and other is the worst (or the least important) alternative. The Marginal analysis model takes into account that the subject makes two decisions per choice set, one best option (for example, among the options A, B and C) and one worst option (for example, among the options –A, –B and –C), simultaneously.

Equation 7.3 and 7.4 show the empirical model of Paired and Marginal analysis approaches, respectively. In both approaches, ($const$) is the constant term; β_i is the impact or weights of attribute *i* and β_{z_i} is the utility ($\beta_{z_i} > 0$) or disutility ($\beta_{z_i} < 0$) of moving from one level of an attribute to another level of the same attribute. The Marginal analysis approach also allows the estimation of the constant(β_{bw}). If this constant is statistically significant, it means that there are differences between the distribution of the best options statements and the distribution of the worst options statements.

$$\ln(f) = cnst + \sum_{i=1}^{m-1} \beta_i X_i + \sum_{i=1}^{m} \sum_{z_i=1}^{z_i=q-1} \beta_{z_i} X_{z_i} \qquad 7.3$$

$$\ln(g) = cnst + \beta_{bw} + \sum_{i=1}^{m-1} \beta_i X_i + \sum_{i=1}^{m} \sum_{z_i=1}^{z_i=q-1} \beta_{z_i} X_{z_i} \qquad 7.4$$

The dependent variables change according to the used method and approach. For MNL estimations the dependent variable takes value 1 if the alternative or pair of alternatives is chosen and zero otherwise. In the case of WLS, the dependent variable (f) of Paired Analysis is the number of times that one particular pair of alternative was selected across all sampled consumer plus a constant (0.058824). This sum is necessary because there is the possibility that a particular pair of alternatives would be never chosen and it was also applied in the Marginal analysis. So, Goodman (1968) made some suggestions to avoid problems with natural logs. This role also was followed for the dependent variable (g) of the Marginal analysis. This approach represents the number of times that a particular attribute-level is selected for all sampled consumers across the experiment as best option and as worst option. The coding of attribute-level changes in the input matrix when it refers to ether the best or worst option.

The independent variables matrices were coded as suggested by Flynn *et al.* (2007). They proposed to use effect code for attributes-levels and attributes. In both cases the code value was 1, if it represents the best option, -1 when it was the worst option and 0 (zero) if it was not there. This rule is the opposite (-1 to best and 1 to worst) only for the reference attribute's level in effect codes. The advantage of using effect code is that they are correlated within attributes but are uncorrelated with the grand mean, unlike Dummy variables (Louviere *et al.*, 2000). The estimated parameter is the marginal utility of that attribute level at the mean utility, then the additional utility

7.2.3 Experimental design and survey

Four late season peaches' attributes have been selected based on the literature review about fruit quality and market tendencies, a focus group, some interviews with fruit and vegetable section managers of three retails distribution chains in Zaragoza city and local market monitoring (Chapter 2). Those attributes were peaches' origin, price and size and type of packing. Three levels heve been also considered for each attribute. They are listed on table 7.4.

Table 7.4 Attributes and their levels employed in the experiment

Attribute	Attribute's level	Attribute	Attribute's level
Origin	From Calanda area with PDO	Size	Small (160g)
	From Calanda area without PDO		Medium (250g)
	From other area without PDO		Largest (380g)
Packing	Active packing	Price	1.2€/kg
	Normal packing		2.4€/kg
	Bulk		3.6€/kg

Effect codes heve been employed to analyse the attribute impact and the attribute levels utility. The reference level for the origin is peaches "from Calanda without PDO". Then the estimated parameter of the level: "from Calanda with PDO" refers to the utility, or disutility, that consumers would have if they would change a peach from Calanda without PDO by one from Calanda with PDO. It means how much consumers value the guarantee of peaches with controlled quality linked to the PDO brand. The difference between parameters of peaches "from Calanda without PDO" and those "produced in other areas" assesses how much consumers value the production of peaches coming from Calanda, but without the guarantees associated with the PDO brand.

Different peaches' sizes were shown to respondents in the experiment. The weight of a small peach was about 160g, a medium size was around 250g and a big one was around 380g. The first weight corresponds to a peach that would be refused by the

PDO norms. The second is the minimum peach size accepted by the PDO norms and the largest represents a size that nobody would be able to eat at once. Normally, bigger peaches are related to higher quality, and moreover there is a market segment that value positively larger peaches up to the point of satiating their eating capacity.

The experiment includes two different types of packing, one normal and other active. Respondents were informed that active packing does not imply health effects and it allows keeping stocks 12 days more than with no active packing.

The attributes and their levels were distributed based on an orthogonal main effect plan (OMEP), as suggested by Flynn *et al.* (2007). The OMEP provides $2\sum_{i=1}^{K-1}\left[L_i \sum_{k=i+1}^{K} L_k\right]$ pairs of alternative combinations – in our case, there are 108 pairs of alternatives combinations for the Paired analysis model and $2\sum_{k=1}^{K} L_k$ alternatives combinations – in this case 24 alternatives for the Marginal analysis model, which are necessary for attribute-level *maxdiff* experiment analyses. The attributes levels combinations were expanded from the web site: http://research.att.com/~njas/oadir/, as proposed by those authors.

A balanced design was achieved. When each attribute level appears equally often in the experiment, the experimental is balanced and it does not need to carry weighting corrections to estimate parameters. All consumers answered questionnaires with 9 choice sets and each choice set is a hypothetical peach. They decided which alternative (attribute level) was the most and the least important to justify their purchasing behaviour.

Although Lancsar *et al.* (2007) recognise that there are other which obtained good results with sample sizes smaller than 100 respondents. They suggest that, through Monte Carlo simulations and with WSL estimations, 150 respondents should be the smallest sample size to obtain accurate estimations.

7.2.4.1 Attributes' impacts and attributes-levels' utilities in a homogenous market

In this section there are comparisons between results of preferences estimations from 2 models, Weight Least Square (WLS) and Multinomial Logit (MNL), calculated by two approaches, Paired and Marginal Analysis. WLS models have been estimated using the SPSS software and Multinomial Logit (MNL) models by employing the free software Biogeme version 1.7 (Barbiere, 2008). The main results are shown in Table 7.5.

Table 7.5 Estimation of relative attributes impacts and attributes' levels utilities, on PDO Calanda peaches purchasing

	Weight Least Square model		Multinomial Logit model	
	Paired Analysis	Marginal Analysis	Paired Analysis	Marginal Analysis
Constants				
Best-worst indicator		- 0.24**		0.00^{ns}
Constant	2.64***	4.91***	0.00^{ns}	0.00^{ns}
Attribute impacts				
Price	- 0.04^{ns}	- 0.02^{ns}	- 0.01^{ns}	- 0.03^{ns}
Origin	0.60***	0.84***	0.86***	1.05***
Size	0.03^{ns}	0.03^{ns}	0.01^{ns}	0.03^{ns}
Packing	-	-	-	-
Level scale values				
1.2€/kg	0.46***	0.43***	0.47***	0.59***
2.4€/kg	0.02	0.02	0.05	0.06
3.6€/kg	- 0.48***	- 0.45***	- 0.52***	- 0.65***
From Calanda With PDO	0.75***	0.71***	1.14***	1.35***
From Calanda Without PDO	0.23	0.24	0.04	0.10
Other area without PDO	- 0.98***	- 0.94***	- 1.18***	- 1.45***
Bulk	0.20**	0.22*	0.23***	0.29***
No active packing	0.07	0.02	0.04	0.06
Active packing	- 0.27***	- 0.24*	- 0.27***	- 0.35***
Smallest size	- 0.63***	- 0.63***	- 0.75***	- 0.94***
Medium size	0.24	0.29	0.34	0.42
Largest size	0.37***	0.34***	0.42***	0.52***
Adjusted R^2 (%)	73.40	89.50	14.30	16.40
F value	27.84	17.34		
Sign.	0.00	0.00		
Nº of observations	108	24	1,908	3,816
Final log-likelihood			-4,050.42	-4,408,11
CAIC			8,203.49	8,936.42

Note: The symbol (***) represents parameter statistically significant at 1%, (**) at 5%, (*) at10% and (^{ns}) it is not statistically significant.

The different nature of attribute-level maxdiff estimations, by WLS and MNL models, has consequences for the proportion of explained variance (measured by adjusted R^2). WLS models explain at least 73% of the consumers' choices variance while MNL models explain around 15%. Although the WLS Paired Analysis has lower adjusted R^2 and lower CAIC, it provides better fitting (F-value) and more accurate parameters (with greater statistical significance). It can be explained by the number of observations, that is 108 (pairs of alternatives combinations) in the Paired analysis and

24 (alternatives combination – 12 as most important and 12 as least important) in the Marginal Analysis.

The number of observations is also different between approaches in the MNL model. There are 1,908 observations (212 consumers x 9 choice sets per consumer x 1 choice per choice set) in the Paired Analysis and 3,816 observations (212 consumers x 9 choice sets per consumer x 2 choices per choice set) in the Marginal Analysis. It is considered that consumers one make choice per choice set in Paired Analysis and they are selecting that pair of options which maximise the utility difference. In the Marginal model it is considered that consumers choose one alternative that maximizes their utility and other alternative that minimises the utility. Thus, consumers are taking 1,908 choices between 12 [k(k-1)] alternatives in the Paired Analysis and they are making 3,816 choices between 4 alternatives in the Marginal Analysis. The result is that the Marginal Analysis has higher adjusted R^2 than the Paired Analysis and the Paired has lower Log likelihood.

The origin of peaches is the attribute with greatest impact on consumers' choice decisions. Its impact is the only statistically different attribute when considering the reference attribute: packing. The other attributes impacts are very similar to packing impact and there are not differences statistically significant.

Although consumers have positive utility if peaches are produced in the Calanda area, they prefer those with PDO Calanda. Peaches produced in other areas, different from Calanda, have negative utility, i.e., they influence the purchase decision negatively. Using a more conservative analysis, the Paired Analysis from the WLS model, it is found that consumers pay more attention to peaches origin than PDO brand because the marginal utility between the attribute levels "from Calanda area with PDO" and "from Calanda area without PDO" is smaller (0.52 = 0.75 – 0.23) than the marginal utility between peaches "from Calanda area without PDO" and "from other areas without PDO" [1.19 = 0.23 – (-0.96)].

When the survey was undertaken, current prices of PDO Calanda peaches at hypermarkets varied between 1.29€/kg and 1.94€/kg. Although the highest price at market was 1.94€/kg, consumers had positive utility with medium (2.4€/kg of peaches) prices and only negative (disutility) utility with highest prices (3.6€/kg). This current price range may explain the greater marginal utility between medium and high price

[0.52 = 0.04 – (-0.48)] than the marginal utility between medium and low price (0.40 = 0.44 - 0.04). In this case, it seems that consumers have smaller marginal utility when the price range is more similar to the current price range in the market.

In relation to packaging, the most preferable attribute level is peaches in bulk. It provides utility of 0.18 while normal (no active) packing utility is 0.05 and active packing is -0.24. Consumers dislike active packing because it is less natural. Although it does not affect consumers' health or fruit taste and it increases the storage period, it is considered that has a treatment. On consumers' point of view, this treatment decreases the peach quality and it affects negatively their purchase decisions.

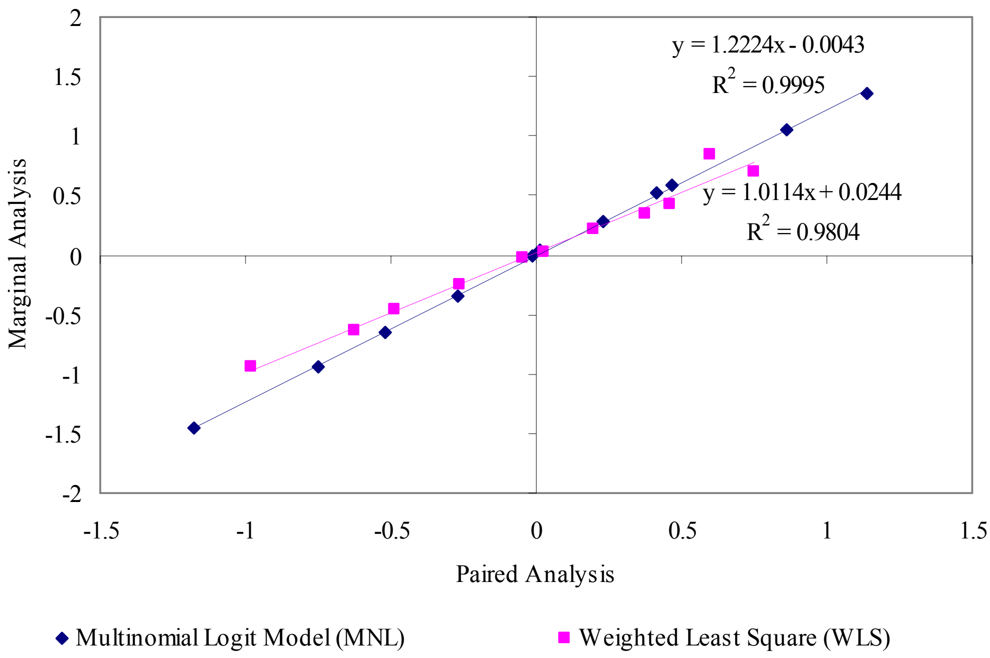
Consumers prefer big peaches to small ones. Small (160g), medium (250g) and largest (380g) size peaches have utilities of -0.24, 0.23 and 0.37, respectively. Consumers have greatest benefits when comparisons are made between small and medium size because the marginal utility between this two sizes is 0.47 [0.23 – (-0.24)] while between medium and largest sizes is 0.14 (0.37 - 0.23).

The estimated parameters agree with Flynn *et al.* (2008) results. It is found that aggregated models (WLS) and individual-level models (MNL) as well as Paired and Marginal Analyses provide similar results. All estimated parameters have linear relations with high determination coefficient ($R^2 > 95\%$), but they do not state which method and approach is more sensitive.

Graphic 7.1 shows the relationships between estimated parameters (attributes impacts and attribute-levels utilities) by different methods (MNL and WLS) with different approaches (Paired and Marginal). In all cases high determination coefficient ($R^2 > 0.98$) are also found. The estimated parameters of the Paired Analysis are presented in the abscissa axis and estimated parameters of the Margina Analysis at the ordinate axis.

The linear tendency between estimated parameters of Paired and Marginal Analysis approaches, for MNL and WLS models, are calculated. In these regressions is possible to note that both approaches give closer results in the WLS model. On average, the Marginal Analysis provides estimated parameters only 1% higher than the Paired Analysis in the WLS model, while this difference increases to 22% on MNL models. It means that one can employ the Marginal Analysis as well as the Paired Analysis when preferences are estimated by WLS, while when the MNL model is used, especially for individual level analyses, the Paired Analysis provides more conservative interpretations of preferences than Marginal Analysis.

Graphic 7.1 Relation between attributes impacts (a) and attribute-levels utilities (b) estimated by WLS and MNL of Paired and Marginal models



Estimations assume that preferences across sampled consumers are homogeneous (Table 7.5). Next section considers preferences heterogeneity and consumers responses are analysed, at individual level, with the Paired analysis by the MNL model. Consumers' tastes differences can give greater information for policy makers (government and business men) to elaborate plans to increase peach consumption.

7.2.4.2 Unobserved heterogeneity on consumers' preferences

In the last section it was considered that all consumers have the same preferences, however it is well known that individual have different preferences. In this section, it is estimated that attributes and attributes-levels of late season peaches have significant heterogeneity across sampled consumers.

Mixed logit models offer an extended framework to capture greater amount of truly behavioural variability in choice making than MNL models. Mixed logit models are closer to reality than most discrete choice models, with every individual having their own inter-related systematic and random components for each alternative in their perceptual choice sets.

Discrete choice models become less restrictive in their behavioural assumptions. It allows the identification of sources of preference heterogeneity associated with a mean and variance of systematic and random component.

The presence of preference heterogeneity in the sample population might be handled in the context of fixed parameters through data segmentation (a model estimation for each consumers' characteristic – male, female, etc.). The random parameters model allows a more general representation of preferences by valuing the preference heterogeneity around the mean of a random parameter (Hensher and Greene, 2003).

The presence of interaction between an estimated parameter with its covariant reveals that there is heterogeneity around the mean of this estimated parameter. If there is not statistical significant interaction in the model, it can be concluded that there is an absence of heterogeneity around the mean taking into account the considered covariant. However, it is not possible to conclude that there is not heterogeneity around the mean, but that there is a failure to reveal its presence (Hensher and Greene, 2003).

For this reason, first it is detected which late season peach characteristic has heterogeneity on consumers' preferences and then, for those characteristics which present heterogeneity, the interaction between consumers and peaches characteristics is calculated.

7.A) Mixed Logit models for the Paired Analysis approach

Traditionally, the Mixed Logit model specification considers that person q (q=1,…, Q) has utility with alternative i in the choice situation t (equation 7.5). It is also assumed that this person faces I alternatives (i =1,…,I) and he will select the alternative i if its relative utility over other alternatives is higher. Equation 7.5 describes an additive function, that is, the total utility of alternative i results from the sum of the partial (dis) utility of each alternative's characteristic (x_i). In this case, the vector of non-stochastic, or explanatory variables is x_{qit}, which is observed by the analyst and the coefficients' vector β_q and the error term e_{qit} are unobserved. It is imposed that this error term is independently and identically distributed (IID), independently of β_q and x_{qit}, with extreme value type 1.

$$U_{qit} = \beta_q x_{qit} + e_{qit} \qquad 7.5$$

This is the first time that preferences heterogeneity, for attributes and attribute - level, are studied with mixed models maxdiff experiments. For this purpose the Paired Analysis approach is considered because, as shown in the section 3.1, this approach provides estimated parameters with better accuracy and with more conservative interpretation than the Marginal Analysis.

In attribute-level maxdiff experiments, each alternative corresponds to a level an attribute and person *q* states two alternatives in each choice set, one with the highest utility (z_i) and another one with lowest utility (z_j). However, for the Paired Analysis approach, it is supposed that person *q* makes one choice per choice set, he selects that pair of alternatives (z_i, z_j), between [I*(I-1)] pairs of alternatives, who maximizes the utility difference (he makes only one choice per choice set). Thus, equation 7.5 changes to equation 7.6 for the Paired Analysis approach.

$$U_{qit} - U_{qjt} = \beta_q x_{q,ij,t} + e_{q,ij,t}\text{, for } i \neq j \qquad 7.6$$

Where, $x_{q,ij,t}$ is the vector of non-stochastic, or explanatory variables, of the pairs of alternatives, which are realised by the analyst. The coefficients' vector β_q and the error term $e_{q,ij,t}$ are unobserved. It is imposed that this error term is independently and identically distributed (IID), independent of β_q and $x_{q,ij,t}$, with extreme value type 1.

The IID assumption is restrictive because its does not allow correlation for the error components of different alternatives. One way to take this correlation in account is to divide the stochastic component additively into two parts. One part is correlated and heteroskedastic in relation to alternatives and the other part is IID in relation to alternatives and individuals as shown in equation 7.7. For the Paired Analysis approach it can be adapted to equation 7.8 (ignoring the subscript t).

$$U_{qi} = \beta' x_{qi} + \lfloor \eta_{qi} + \varepsilon_{qi} \rfloor \qquad 7.7$$

$$U_{qi} - U_{qj} = \beta' x_{q,ij} + \lfloor \eta_{q,ij} + \varepsilon_{q,ij} \rfloor, \text{ for } i \neq j \qquad 7.8$$

Where, η_{qi} is a random term with a distribution of zero mean made out of alternatives and; for the Paired Analysis, $\eta_{q,ij}$ is also a random term, with zero mean made out of pairs of alternatives. In traditional discrete choice experiments, the term ε_{qi}; and for Paired Analysis approach, random term $\varepsilon_{q,ij}$ have mean zero and they are IID, respectively, over alternatives and pairs of alternatives. Hence, for traditional choice analysis and for the Paired Analysis approach the log likelihood functions as Mixed logit models can be expressed as equation 7.9 and 7.10, respectively.

$$L_{qi}\left(\beta_q \middle| \eta_{qi}\right) = \frac{\exp\left(\beta_q' x_{qi} + \eta_{qi}\right)}{\sum_s \exp\left(\beta_q' x_{qs} + \eta_{qs}\right)} \qquad 7.9$$

$$L_{q,ij}\left(\beta_q \middle| \eta_{q,ij}\right) = \frac{\exp\left(\beta_q' x_{q,ij} + \eta_{q,ij}\right)}{\sum_{s,t} \exp\left(\beta_q' x_{q,st} + \eta_{q,st}\right)} \qquad 7.10$$

Mixed Logit models assume that η_{qi} (for the Paired Analysis approaches is $\eta_{q,ij}$) has a determined statistical distribution and with IID extreme value type 1. The unconditional choice probability is given by a logit formula equation 7.11 integrated over all values of η_{qi} weighted by $f\left(\eta_{qi} \middle| \Omega\right)$ that denote the density of η_{qi}, where Ω are the fixed parameters of the distribution. For the Paired Analysis approach the unconditional choice probability is expressed as Equation 7.12.

$$P_{qi}\left(\beta_{qi}\middle|\Omega\right)=\int_{\eta_{qi}} L_{qi}\left(\beta_{q}\middle|\eta_{qi}\right)f\left(\eta_{qi}\middle|\Omega\right)\eta_{qi} \qquad 7.11$$

$$P_{q,ij}\left(\beta_{q,ij}\middle|\Omega\right)=\int_{\eta_{q,ij}} L_{q,ij}\left(\beta_{q}\middle|\eta_{q,ij}\right)f\left(\eta_{q,ij}\middle|\Omega\right)\eta_{q,ij} \qquad 7.12$$

The choice probability P_{qi} and $P_{q,ij}$ are a mixture of logit models with *f* as the mixing distribution. The choice probability does not exhibit the questionable independence of irrelevant alternatives (or pair of alternatives) and property IIA and different substitution patterns may be obtained by an appropriate specification of *f*. This is handled in two ways. The first, known as the random parameters specification, involves specifying each element of β_q, associated with an attribute or in the case of the Paired Analysis approach with an attribute-level, as having a mean and a standard deviation. The second way is known as the error component approach, treats the unobserved information as a single separate error component in the random component, as expressed in equations 7.9, 7.10, 7.11 and 7.12.

The parameters distributions are unknown in these models and it represents a challenge for the estimations. According to Hensher and Greene (2002) the concern that one might not know the location of each individual's preference on the distribution can be accommodated by retrieving estimates of individual-specific preferences by deriving the individual's conditional distribution based on their choices. Using Bayes Rule, we first define the conditional choice probability, in equation 7.13 for TDCE and equation 7.14 for the Paired Analysis model.

$$H_{qi}\left(\beta_{q}\middle|\Omega\right)=\frac{L_{qi}\left(\beta_{q}\right)g\left(\beta_{q}\middle|\Omega\right)}{P_{qi}\left(\beta_{q}\middle|\Omega\right)} \qquad 7.13$$

$$H_{q,ij}\left(\beta_{q,ij}\middle|\Omega\right)=\frac{L_{q,ij}\left(\beta_q\right)g\left(\beta_q\middle|\Omega\right)}{P_{q,ij}\left(\beta_q\middle|\Omega\right)} \qquad 7.14$$

Where $L_{qi(\beta_q)}$ and $L_{q,ij(\beta_q)}$ are the likelihood of an individual's choice if they had this specific β_q, Ω is the set of parameters in the underlying distribution of β_q, $g\left(\beta_q\middle|\Omega\right)$ is the distribution in the population of β_q s, and $P_{qi}(\Omega)$ and $P_{q,ij}(\Omega)$ are the choice probability function of TDCE and Paired Analysis, respectively, defined in open-form as equations 7.15 and 7.16.

$$P_{qi}(\Omega)=\int_{\beta_q} L_{qi}\left(\beta_q\right)g\left(\beta_q\middle|\Omega\right)d\beta_q \qquad 7.15$$

$$P_{q,ij}(\Omega)=\int_{\beta_q} L_{q,ij}\left(\beta_q\right)g\left(\beta_q\middle|\Omega\right)d\beta_q \qquad 7.16$$

These two last equations show how one can estimate the person specific choice probabilities as a function of the underlying parameters of the distribution of the random parameters.

As the integral of equations 7.11, 7.12, 7.15 and 7.16 do not have a close form, then choice probabilities are calculated through simulations and do not have an exact value. Thus, for given values of the parameters Ω, a value of β_q is drawn from its distribution. Using this draw, the logit formulas 7.9 and 7.10 for $L_{qi}\left(\beta_q\right)$ and $L_{q,ij}\left(\beta_q\right)$ are calculated for the TDCE and for the Paired Analysis approach, respectively. This process is repeated for many draws, and the mean of the resulting $L_{qi}\left(\beta_q\right)$ and $L_{q,ij}\left(\beta_q\right)$'s are taken as the approximate choice probability given by equation 7.17 and 7.18.

$$SP_{qi}(\Omega)=(1/R)\sum_{r=1}^{R} L_{qi}\left(\beta_{qr}\right) \qquad 7.17$$

$$SP_{q,ij}(\Omega) = (1/R)\sum_{r=1}^{R} L_{q,ij}(\beta_{qr}) \qquad 7.18$$

Where R is the number of replications, β_{qr} is the rth draw, and SP_{qi} and $SP_{q,ij}$ are the simulated probability that an individual chooses alternative *i* in the TDCE and select alternatives *i* as best and *j* as worst in attribute-level maxdiff experiments. It remains to specify the structure of the random vector β_q. For example, in our case, the structure is $\beta_q = \beta + \Gamma v_q$, where the fixed underlying parameters are $\Omega = (\beta, \Gamma)$, β is the fixed mean of the distribution, v_q is a vector of uncorrelated random variables with variances on the diagonal of Σ, and Γ is a lower triangular matrix which, because $Var\lfloor\beta_q\rfloor = \Gamma\Sigma\Gamma'$, allows free correlation of the parameters. Thus, a "draw" from the distribution of β_q consists of a draw from the distribution of v_q which is then used to compute β_q.

7.A.1) Detecting heterogeneity on preferences of attributes impacts and attributes-levels utilities

In some studies the random parameters are selected in order to get better fitted model, i.e., some parameters are assumed to be fixed (homogeneity in preferences). However, as our intention is to value the preference heterogeneity across all attributes and attributes-levels, it is calculated by models with no fixed parameters.

The selection of the right random parameters distribution is of a great concern. The different distributions affect the random parameters ranges, measured by their Stand Deviations (SD). The most popular distributions are normal, lognormal, triangular and uniform. The lognormal is more used when, under theoretical restrictions, estimated parameters need to be non-negative. A uniform distribution with a (0, 1) bound a sensible when there are dummy variables (Hensher and Greene, 2003). These authors suggest that testing different distributions is important when the parameters' signs become relevant to interpret the model. In this study it is not assumed any parameter sign previously. Based on that, the normal distributions to estimate the random parameters are used because are well-known.

The findings are not necessarily independent of the number of random draws in the simulation. The number of draws required to secure a stable set of parameter estimates varies enormously. The necessary number of draws varies with the number of alternatives, random variables. In our case, there are 23 parameters and the number of draws is 200.

The free software Biogeme 1.7 was also employed for Mixed Logit estimations, which perform pseudo-random numbers using the Wichura method (Barbiere, 2008). Table 7.6 shows the results of Mixed Logit estimations. In total, it was calculated one model with averages and standard deviations (SD) of each random parameter. The heterogeneity on preferences is measured through SD.

The model states that although only the origin impact is statistically different than packaging impact, all consumers give similar weight to this attribute when they buy late season peaches, i.e., there is homogeneity on their preferences regarding this attribute. Regarding the origins levels preferences, results show that sampled consumers have homogeneity on preferences for peaches from Calanda area with PDO, which means that all of them have high utility when they buy the certified product. However it is detected that there are differences on preferences for peaches produced in other areas without PDO, that is, some consumers have high disutility when peaches are produced in other areas not from Calanda and there is (are) other group (s) of consumers that have smaller disutilities.

Price has comparable impacts on consumer purchase decision than packaging and all consumers value this attribute similarly. However, in relation to its levels, it is found that low prices give positive utility for consumers and their preferences for this level do not vary. On the other hand, on average, consumers have disutilities with high prices and it heterogeneities on preferences for this attribute level is detected. That is, there are consumers that can have higher disutilities than the average and others with lower disutilities (these consumers correspond to the group who would be willing to pay higher values for late season peaches).

Peach size is the only attribute with heterogeneity across sampled consumers. This heterogeneity is assumed at 90% of statistical confidence (or 10% of statistical significance). On average, small size peaches are disliked by consumers and all of them have similar disutilities with this characteristic. Peaches with largest size are desired by consumers, but this preference is not equal for all consumers. Model 1 states that there are different preferences for this attribute level, at 99% of confidence.

Table 7.6 Mixed Logit estimations, by Paired approaches, of attribute impacts and attributes-levels utilities of PDO Calanda peaches.

Variables	Mean	SD
Constant		
Constant	0.00^{ns}	
Attribute impact		
Price	-0.03^{ns}	0.51^{ns}
Origin	1.46^{***}	0.11^{ns}
Size	0.07^{ns}	0.53^{*}
Packaging	-	-
Attribute-level utility		
1.2€/kg	0.72^{**}	-0.15^{ns}
2.4€/kg	0.08	
3.6€/kg	-0.80^{***}	1.09^{***}
From Calanda area with PDO	1.86^{***}	1.65^{***}
From Calanda area without PDO	0.06	
From other area without PDO	-1.92^{***}	-0.07^{ns}
Bulk	0.35^{***}	0.93^{***}
Normal packing	0.02	
Active packing	-0.37^{***}	-1.14^{***}
Smallest	-1.06^{***}	0.07^{ns}
Medium	0.48	
Largest	0.58^{***}	-1.60^{***}
Nº of draws:	200	
Nº of estimated parameters:	23	
Nº of observations:	1,908	
Final log-likelihood:	-4,009.38	
Adjusted rho-square:	0.150	
CAIC	8,215.50	

Note: The symbol (***) represents parameter statistically significant at 1%, (**) at 5%, (*) at10% and (^{ns}) it is not statistically significant.

It is also detected that consumers' preferences for different types of packages are not homogeneous. The standard deviations (SD) of both attribute levels are statistical significant. It means that there are different markets segments for bulk peaches and peaches conditioned in active packing.

7.A.2) Explaining the heterogeneity on preferences of attribute impact and attributes-levels utilities

In order to explain the heterogeneity of consumers' preferences of attribute impacts and attribute levels utilities, Flynn *et al.* (2008a) use the covariance between health care attributes impacts and their attribute-levels utilities and consumers' characteristics. In this section it is estimated the covariance between consumers' socio-demographic and attitudinal features and those PDO Calanda peaches characteristics, which heterogeneity was detected on consumers preferences by the Mixed model (high price (3.6€/kg), peaches from Calanda area with PDO, bulk peaches, peaches in active packing, peach size and largest size peaches).

Two regressions with interactions effects were carried out using the MNL model with the Paired Analysis approach. One measures the interaction effects between attitudinal characteristics and attribute impacts and attribute-levels utilities (Table 7.7) and the other measures the interaction between consumers' socio-demographic characteristics and late season peaches quality (Table 7.8). The considered attitudes are PDO Calanda peaches loyalty degree, PDO Calanda peaches consumption frequency and the socio-demographic characteristics: age, education level, gender and family income.

All consumers' characteristics are divided in two groups. In the case of age it is considered consumers older or younger than 50 years; education levels are divided in those who have elementary education and those with other studies; household income measure the effect of low income level (less than 1,500€/month) and consumer gender is divided in male and female consumers. The attitudinal variables consider the interactions of consumers with high loyalty degree, who are those that would buy other no stone fruit if PDO Calanda peaches are not available in the market, and regular consumers, which are those consumers who consume PDO Calanda peaches during its season more often than once a week.

Results show that consumers with high loyalty degree toward PDO Calanda peaches do not have different preferences than others because all interaction effects are not statistically significant, i.e., their effects are equal to zero. However, regular consumers' parameters present statistically significant interactions effects for peach size, largest size peaches and bulk peaches. In relation to an average consumer, they give more importance to peach size on their buying decision (it is the second most important attribute for them), largest peaches provide higher utility and they prefer peaches sold in bulk.

Table 7.7 The effects of consumers' attitudes toward PDO Calanda peaches consumption on late season peaches attribute impact and attribute-levels utilities evaluation

Variables	Model 4		
		Interaction with:	
	General	Highly loyal	Regular
Constants			
Constant	0.00^{ns}	-	-
Attribute impact			
Price	- 0.10^{ns}	-	-
Origin	0.87***	-	-
Size	-0.18**	0.11^{ns}	0.21***
Packaging	-	-	-
Attribute-level utility			
1.2€/kg	0.47***	-	-
2.4€/kg	0.02	-	-
3.6€/kg	- 0.49***	0.11^{ns}	- 0.12^{ns}
From Calanda area with PDO	1.15***	- 0.02^{ns}	0.01^{ns}
From Calanda area without PDO	- 0.03	-	-
From other area without PDO	- 1.18***	-	-
Bulk	0.16^{ns}	0.12^{ns}	0.01*
Normal packing	0.02	-	-
Active packing	- 0.18*	- 0.05^{ns}	- 0.10^{ns}
Smallest	- 0.76***	-	-
Medium	0.55	-	-
Largest	0.21**	0.04^{ns}	0.28***
Number of estimated parameters:	24		
Number of observations:	1,908		
Final log-likelihood:	-4,038.37		
Adjusted rho-square:	0.143		
CAIC	8,282.04		

Note: The symbol (***) represents parameter statistically significant at 1%, (**) at 5%, (*) at10% and (^{ns}) it is not statistically significant.

Results from Table 7.8 explain the heterogeneity on consumers' preferences according to socio-demographic characteristics. Older or younger consumers than 50 years give the same importance to peach size and have the same utility with high price, peaches produced in Calanda area with PDO, peaches in bulk or in active packing and largest peaches because age do not have any parameter statistically different from zero.

Table 7.8 The effects of consumers' socio-demographic characteristics on late season peaches attribute impact and attribute-levels utilities evaluation

Variables	Model 3				
		Interaction with:			
	General	Age	Education	Gender	Income
Constants					
Cnst	0.00^{ns}				
Attribute impact					
Price	- 0.01^{ns}	-	-	-	-
Origin	0.87***	-	-	-	-
Size	0.02^{ns}	0.03^{ns}	0.29***	- 0.26***	0.08^{ns}
Packaging	-	-	-	-	-
Attribute-level utility					
1.2€/kg	0.47**	-	-	-	-
2.4€/kg	- 0.13	-	-	-	-
3.6€/kg	- 0.34*	- 0.14^{ns}	- 0.14^{ns}	- 0.16*	0.11^{ns}
From Calanda area with PDO	1.15***	- 0.02^{ns}	- 0.20*	0.09^{ns}	0.06^{ns}
From Calanda area without PDO	0.04	-	-	-	-
From other area without PDO	-1.19***	-	-	-	-
Bulk	0.19^{ns}	- 0.15^{ns}	0.15^{ns}	0.12^{ns}	0.02^{ns}
Normal packing	- 0.10	-	-	-	-
Active packing	- 0.09^{ns}	0.16^{ns}	- 0.23*	- 0.25**	- 0.11^{ns}
Small	- 0.76***	-	-	-	-
Medium	0.36	-	-	-	-
Largest	0.40^{ns}	- 0.06^{ns}	- 0.18*	0.03^{ns}	0.23**
Number of estimated parameters:	36				
Number of observations:	1,908				
Final log-likelihood:	-4,019.45				
Adjusted rho-square:	0.145				
CAIC	8,346.84				

Note: The symbol (***) represents parameter statistically significant at 1%, (**) at 5%, (*) at10% and (^{ns}) it is not statistically significant.

Education level explains the preference heterogeneity of peach size importance and utility from Calanda area with PDO and largest size peach. Consumers with elementary education level attach more importance to peach size, even with lower utility with largest peach size and they also have lower utility with peaches from Calanda area with PDO than the average.

The preferences are different for people with different gender. Women give less importance to peach size in their decisions; however they have not different utility with largest peaches. Women have lower utility with high price and peaches conditioned in active packing than men. The household incomes only explain the preferences for largest size peaches, in which consumers with household income lower than 1,500€/month have higher utility with this kind of peaches.

In summary, only gender explain (with 90% of confidence) the differences in preferences for high price, only different education level have different utilities with peaches from Calanda area with PDO and only consumption frequency value differently bulk peaches. Age and loyalty degree have not explained any considered parameter of late season peaches.

7.3 Final remarks

The attribute-level maxdiff experiment is a relevant tool to study of consumers' preferences. The experiment allows measuring the attribute impact and attribute-level utility on choice decisions on the same scale. Theoretically, even if all attributes-levels are not distinguishable for consumers, this method detects if the attribute is important or not to them.

Attribute-level maxdiff sources can be estimated by four approaches. Each approach can be estimated with a different model (Weighted Least Square (WLS) or Multinomial Logit (MNL)), and with different analyses (Paired or Marginal Analysis).

In this work, the consumers' preferences for late season peaches in Zaragoza city have been studied. The attributes impacts or importance and attributes-levels utilities are the considered parameters. Considering the average preference, i.e., taking into account estimations at sample level, origin is the most important attribute that explains consumers purchase decisions. The impacts of price and peach size on purchasing are not statistically different than the packaging impact.

In relation to attribute-level, consumers have distinguished them on their choices because all attribute-levels are statistically significant. Consumers have positive utility with peaches from Calanda area with or without PDO, although peaches with PDO give higher utility than without PDO. Peaches produced in other areas without PDO influence negatively purchases decisions. This negative influence is even greater than the positive influence of peaches from Calanda area with PDO.

Regarding packing types, consumers prefer bulk peaches than those peaches conditioned in normal packing. No active packing also gives positive influence on purchase, but the influences of active packing is negative. It shows that there is a strong preference for natural products over those with more treatments, even adding benefits as longer preserving time.

Peach size is an important issue in the peaches industry. Growers adopt techniques that increase peaches size but, on the other hand, they decrease peach productivity. As a result of this experiment, consumers from Zaragoza city have positive utility with medium size peaches (weighting around 250g) and they have greater utility with largest size peaches (around 380g). It is also found that the positive influence of largest peaches is smaller than the negative influence of smallest size peaches (with weight around 150g). So, considering the market with homogeneous preference, it is advisable to produce peaches with size above 250g.

Although price impact on purchase decision is statistically equal to packaging and packing impacts, it has smaller value. It means that they give less importance to this attribute when they buy late season peaches. Concerning price levels, consumers have shown positive utility with low prices (1.2€/kg) and medium price (2.4€/kg). Medium size price utility is almost zero, probably because this price was very similar with the current prices in the market, when the survey was applied. High prices affect negatively purchase decisions in all approaches.

Previous work, as Llynn *et al.* (2008b), find high correlation between estimated parameters from different approaches; however, they do not state which approach provides more conservative results. Based on our results, it is observed that estimated parameters from the WLS model have not great differences if they are calculated by the Marginal or Paired Analysis approaches. However, the estimated parameters from the MNL model present differences around 20% if they are estimated by Marginal or Paired

Analysis. Thus, considering only the relation between estimated parameters of attribute impact and attribute-level utility, there is an indifference between the Paired or Marginal Analysis if it is used WLS, but if it is used the MNL model, estimations from the Paired Analysis provides results around 20% more conservative than the Marginal Analysis.

This indifference of estimated parameters from WLS models, by different Analysis approaches, is a good characteristic. WLS models only allow for estimations at sample level, while MNL models make estimations at individual level. Estimations at individual levels allow exploring the heterogeneity of preferences from sampled consumers.

In this work, the preferences are dealing first with Mixed logit models and, in the sequence, they are estimated the interactions between consumers profiles and those estimated parameters with heterogeneity on consumers preferences. The estimated Mixed logit model has found that the peach size is only attribute with heterogeneity on preference. It has also been detected that there are heterogeneity on preferences of high price, peaches from Calanda area with PDO, bulk, active packing and largest size peaches utilities.

PDO Calanda peaches consumption frequency, education level and gender have significant interactions with peach size impact. Regular consumers, and those with elementary education level give more importance to peach size and women give less importance to this attribute on their buying decisions than men.

The differences of high price utilities could be explained just by gender. At 90% of confidence it is possible to say that women have higher disutility with high price than men, i.e., women are more sensitive to high price than men. This finding is very important because women go shopping mostly on their own.

In relation to the different preferences of origins' level, from Calanda area with PDO, only education level explains this heterogeneity at 90% of confidence. Consumers with elementary education level have less utility than other consumers.

The mixed model detected differences in the utility of both packing levels. In the interaction estimations it is found that only regular consumers have higher utility with bulk peaches while socio-demographic variables do not have any relation with this level. The elementary education as well as women have different utility for active packing and both groups have higher disutility with this kind of packing than the rest of consumers.

The differences on largest size peaches preferences can be related to PDO Calanda peaches consumption frequency, education level and household income. Regular consumers and those families with higher incomer than 1,500€/month have higher utility with largest peaches while consumers with elementary education have less utility.

7.3.1 Some limitations of this work and future works

Although the attribute-level maxdiff experiment gives good information about attribute impact and attribute-level utility for consumers, this estimation provides unknown anchor results, that is, analysts cannot know at which point attribute impact become positive on respondents choice decisions. Lancsar *et al.* (2007) affirm that this lack of anchoring affects the predictability of consumers' choices and the welfare measures of attribute-level maxdiff experiments. According to Flynn *et al.* (2008a) adding a new question to respondents asking them if they would purchase that product or not and combining that information could work as anchoring the preferences estimated by the attribute-level maxdiff. Thus, further research should be undertaken in this issue because as tasks are different their random components are different in both experiments and nature (different variance and scale factor). Flynn *et al.* (2008b) estimate rescaling parameters for anchoring preferences and their work can be a good starting point to this issue for attribute-level maxdiff experiments.

Our perception of this experiment is that this additional question would be feasible in the experiment, because the extra effort of consumers would not carry out a decrease of their quality response. When the survey was applied many consumers made comments that they would like or not to buy that peach. Hence, this additional question would provide further information to estimate unconditional models, for example, with probit analysis, without extra respondents' efforts.

The experimental design is also a new field for this experiment. Until now the references were about how to get the total number of combinations that allow estimations by different approaches. On the other hand there are not references about the experimental design efficiency or to diminish the number of respondents. The results provided in this chapter points that each approach has a different performance and dependence in relation with sample sizes. Thus, theoretical advances should deals separately with each approach.

Current experimental designs allow only main effect estimation of attributes impacts and attribute-levels utilities. The interaction effects between those variables are also another relevant issue for future research. Those studies would state, for a given number of attributes and levels, the number of profiles (choice sets) and if it is possible to work with different versions (blocking).

Chapter 8: Summary, conclusions and future researches

8.1.1 Summary

The main aim of this work is to study consumers' preferences toward Protected Designation of Origin (PDO) Calanda peaches, in the city of Zaragoza (Spain). PDO Calanda peaches are offered in the market during a short season, from the middle of September until the beginning of November. Their differentiated quality, which has high repute, is the main factor which justifies why consumers have a high Williness-to-Pay (WTP).

A previous work detected that consumers were willing-to-pay more for PDO Calanda peaches than other peaches with similar characteristics, however the information was obtained from wholesalers who were trading PDO Calanda peaches. In this study, information about preferences has been obtained directly from consumers, which is closer to the real preferences.

At the beginning of this study (Chapter 1), general explanations are provided concerning fruit consumption and production, and more especifically dealing with the peaches, both in global terms and in Spain. In Spain, the socio-economic changes during the last decades have propitiated notable shifts in food consumption habits. Less and less people follow the Mediterranean diet, which is associated with sedentary lifestyles, and it has had affected public health and population welfare.

The second chapter tries to understand and select the main quality parameters of PDO Calanda peaches. Thus, first a literature review has been carried out; later a Focus Group is performed as well as many interviews to experts followed by retail market monitoring of yellow peaches in Zaragoza city, in 2008. Although results are not displayed, a yellow peaches price monitoring was also executed in 2009.

As a result of this initial research, 10 PDO Calanda peaches' attributes (taste, colour, price, production in bags, smell, peach size, packaging, ripeness, skin fuzziness and texture) have been selected to study consumers' preferences as well as those characteristics that influence consumers' WTP. Those characteristics correspond to 4 attributes with 3 levels each one, such as: different type of packaging (bulk peaches, peaches conditioned in normal packing and in active packing), peach sizes (smallest, medium and largest), peaches' origin (from Calanda area without PDO, from Calanda area with PDO and from other areas without PDO) and price. Two surveys were carried out, one in 2008 and another in 2009. For the 2008 survey, prices levels were: 1.5€/kg,

2.5€/kg and 3.5€/kg, and for the 2009 survey price levels were: 1.2€/kg, 2.4€/kg and 3.6€/kg. The rest, attributes and attribute-levels, were maintained in both surveys.

In 2008 316 consumers were surveyed and 212 in 2009. In both cases, the sample error terms are within acceptable limits for this kind of study (5.6% and 6.9%, respectively). Both surveys are described by univariate and bivariate analyse in the third chapter.

8.1.1.1 Regular consumer of PDO Calanda peaches

Consumers are grouped into regular and sporadic. Regular consumers cover two third of the sample and they are characterised by those who eat PDO Calanda peaches more than once a week during its commercialization season, while sporadic are those who consume them less often. The regular PDO Calanda peaches consumers' characteristics are listed in the Table 8.1.

According to surveys data, regular consumers are characterised as older people, with lower education level, a greater proportion of them are dedicated full time to household activities and they have lower household income than sporadic consumers. They are also more used to eat peaches since their childhood and they have a stronger believe that they are able to recognize peaches quality when they are purchasing them.

Regular consumers disagree more with the statement that they prefer packaged peaches because they lack shopping time. Further, some regular consumers are retired and, consequently, they have more time to go shopping. Another limitation to consume packaged peaches by consumers of this group is the period of time that they store the product in their houses. Regular consumers store PDO Calanda peaches less time than sporadic.

Therefore, sporadic consumers are more interested in packaged peaches, especially in active packing because it stores peaches for longer time. However, sporadic consumers think that packaged peaches can affect their health more negatively than what regulars think about it. Sporadic consumers perceive that packaged peaches have worse organoleptic quality features than regulars' perceptions. In order to increase packaged peaches acceptance by sporadic consumers it is necessary educational programs and to advertise them stressing their health consequences and organoleptic quality.

Although, on average, all consumers have declared to be satisfied with PDO Calanda peaches' taste, sporadic consumers think that its taste can be improved and regular consumer feel more satisfied.

Table 8.1 PDO Calanda peaches regular consumers differential characteristics

Characteristic type	Its uniqueness
- Socio-economic	- Older; low education; dedicate more time to household activities; low household income
- Consumption behaviour	- Greater proportion consume peaches since their childhood; more able to identify peach quality
- Attitude toward PDO Calanda peaches	- More satisfied with its quality; greater desire to extend the supply period; more ethnocentric; higher loyalty toward PDO Calanda peaches; think that are healthier, pollute less; give more importance to production in bags; and agree less that it is more nutritive
- Attitude toward packaging uses	- Perceive lower health risk; lower risk of changing taste and smell; they do no feel need of buying packaged peaches for lacking of shopping time

Regarding PDO Calanda peaches evaluations, regular consumers have a more ethnocentric attitude than the sporadic because they think with greather enphasis that purchasing PDO Calanda peaches would prevent entering peaches from other areas and, for this reason, they would have benefits with the development of the local economy. They also say that, given its production techniques, PDO Calanda peaches pollute the environment less, that they are healthier and they are also more nutritive than other peaches. In general, all consumers desire that the period that PDO Calanda peaches are in the market should be extended; although regular consumers are more open to this change. Both consumers groups are indifferent about the extention of the offer should be before or supply whether it the current market period.

Another difference between regular and sporadic consumers is their loyalty degree toward PDO Calanda peaches. The loyalty degree has been measured, with spontaneous (survey 2008) and suggested (survey 2009) statements, checking consumers' propensity to change PDO Calanda peaches for other fruits. Consumers have been classified as of low, medium and high loyalty. Low loyal consumers are those who choose a more similar fruit to PDO Calanda peach, i.e., another peach; medium loyal consumers are those who choose another stone fruit, such as nectarines or "*pavia*"; and high loyal consumers are those who would not choose another stone fruit as PDO Calanda peaches as a substitute. Results show that with suggested statements consumers tend to be less loyal. Thirty percent of consumers are low loyalty, 20% are of medium loyalty and 50% are high loyalty toward PDO Calanda peaches. Regular consumers are more loyal toward PDO Calanda peaches than sporadic, because almost 73% of them are high loyal while this percentage is 58% for sporadic consumers.

8.1.1.2 PDO Calanda peaches' attributes relative importance

The relative importance of PDO Calanda peaches attributes on purchase decision has been measured through Best-Worst Choice Experiments. In this experiment, consumers have to state the best, or the most important attribute, and the worst or the least important attribute, among 4 attributes options, which influence their purchase decisions. This kind of experiment has been carried out because consumers' trade-off the attributes importance, and they are forced to select one or another option, thus they make better discrimination among attributes' importance. Moreover, this method avoids scale bias related to consumers answering behaviour.

Consumers' responses have been analysed employing two approaches, the Best-Worst Score (BWS) and Multinomial Logit model (MNL). Based on the first approach (BWS), the importance order, from the most to the least, of the 10 main PDO Calanda peaches' attributes are: taste, ripeness, smell, colour, price, texture, produced in bags, peach size, skin fuzziness and, as least, packaging. Although colour is more important than price and price is more important than texture, their differences are so small that statistically they can be considered of the same importance to consumers. Regarding their statistical significance, the same observation can withdrawn between produced in bags and peach sizes importance.

Significant correlations of BWS among different attributes have been detected, and they have been clustered in 5 factors. One cluster is conformed by taste and ripeness, the second cluster combines smell and price, the third has colour and packaging together, the forth aggregates texture and peach size and, the last factor, combines production in bags and skin fuzziness importance.

The attributes ranking, ordered according to their importance, calculated with MNL function is very similar to that ranking obtained with BWS. The only difference is that price occupies the 5th position and colour the 4th in BWS, whereas they change their order in MNL estimation. As the relative importance difference between these two attributes, calculated with BWS, is note statistically significant, it is possible to say that the results of both methods are similar.

Results from MNL estimated functions with one kind of option heve been evaluated: either the best (the most important) or the worst (the least important) option. When preferences are evaluated exclusively with the best options, there is an overestimation of the importance of the least important attributes and, if the estimations are carried out only with the worst options, the importance of the most important attributes are underestimated. The best estimations are obtained when both kinds of options are taken into account, at the same time, because it increases the estimation accuracy of the most as well as of the least important attributes.

Consumers' responses variance regarding the most and the least important attributes have also been estimated. On average, the least important options' variance is 4.6% higher than the most important options' variance. It means that there is greater homogeneity on preferences for the most important attributes than for the least important attributes.

The preferences heterogeneity has been studied by two methods: one has been the Mann-Whitney test, which checks the attribute importance ordering between different consumers groups, and the other method has been the Latent Class. Consumers have been clustered according to their socio-economic and attitudes characteristics. The attributes importance differences, for each type of consumers, are summarized in Table 8.2.

In relation to consumers with low loyalty degree toward PDO Calanda peaches, those with high loyalty give greater importance to price and less to peaches' skin fuzziness. Consumers who give the greatest importance to PDO Calanda peaches taste are characterized as individuals aged between 35 and 50 years old, with college education and with monthly household income higher than 3,000 Euros per month. People with the highest household income (greater than 4,000 Euros per month) give little importance to packaging, while people with lowest household income (less than

900 Euros per month) assign higher importance to this attribute. Consumers with household income below 900 Euros per month are also those that give the lowest importance to PDO Calana peaches' ripeness. Ripeness is more appreciated by consumers with college education than those with elementary education. Consumers with elementary education give more importance to packaging than those with college education. The importance of producing PDO Calanda peaches in bags is greater among consumers who are older than 50 years old. The oldest consumers give less importance to skin fuzziness, but give more importance to peaches sizes than those consumers who are between 50 and 65 years old, who are those who giving least importance to peaches size.

It is also found that regular consumers are different from sporadic consumers because they give more importance to producing PDO Calanda peaches in bags (this information is displayed in the Table 8.1).

Table 8.2 PDO Calanda peaches' attributes with different importance according to the different type of consumer

Type of importance	Type of consumer
- More importance to the price	- High loyalty
- Less importance to the skin fuzziness	- High loyalty and which are 50 years old or older
- More importance to the taste	- From 35 to 50 years old, with college education and higher household income than 3,000 €/month
- More importance to the packaging	- Less or equal household income than 900€/month and elemental education
- More importance to the ripeness	- College education
- Less importance to the peaches size	- Between 50 and 65 years old
- More importance to the bag production	- Who are 50 years old or older

Consumers are clustered in 5 classes in accordance with PDO Calanda peaches' attributes' importance. The largest group (Class 1), gathers 27.8% of consumers, and they evaluate the attributes as the average evaluation of all consumers. The second largest group (Class 4) groups 22.3% of consumers and it is characterized for considering price as the second least important attribute and, in relation to the other groups, consumers from this group give more importance to PDO Calanda peaches' sizes. Consumers from Class 2 (16.0%) differentiate from others because they consider price as the most important attribute on their purchase. Consumers from Class 5

(15.3%) consider price as the second most important attribute and they differentiate from those consumers of Class 2 because they give more importance to production in bags and to the peaches' smell. In this breakdown it is important to notice that attributes with medium importance, that were initially considered by BWS and MNL approaches, play a differentiating role.

8.1.1.3 Late season peaches' attribute-levels importance

This section provides results of late season peaches, i.e., those peaches that are sold in the last part of the commercialization period and it includes much larger volume than only PDO Calanda peaches. This analysis is divided into two parts, one part deals with consumers' preference taken at sample level (average preferences are estimated for consumers' groups) and the other part deals with preferences at individual level).

8.A) At sample level

A multiattributes discrete choice experiment employing Best-Worst task with the 2008survey data has been performed. Each option in this experiment results from a different combination of attributes-levels (an attribute-level is a level of an attribute) that conforms different hypothetical peaches' profiles. Consumers have indicated the best and the worst peach and their desire of purchasing the best peach. With the data provided from this experiment, marginal utilities between different late season peaches' characteristics or attributes-levels have been estimated. It was also compared the different models performances.

Results point out that, with only the best options, the conditioned model, i.e., that model where consumers do not have the option of not buying (*status quo*), has had better fit (lowest CAIC) than unconditioned model, when consumers have the not buying option available. In both cases the parameters (marginal utilities) accuracy are similar.

The effect of increasing the number of observations by incorporating the worst options has been evaluated. Doubling the number of observations has diminished the variance explanation power of the models (it has decreased the adjusted R^2) and decreased the models fitting (it has increased their CAIC), but it has increased their estimated parameters' accuracy (significance level). Increasing the number of alternatives in the choice sets has also increased the parameters accuracy and statements variance explanation; nevertheless it has had a negative impact on models fitting.

The Bottom-up model, which increases considerably the number of observations and the number of alternatives in the choice set, has presented the worst fitting (adjusted R^2 and CAIC). Although all estimated parameters present statistical significance, they are less accurate than in other models. Thus the Buttom-up model can be considered as the worst model to estimate the average preferences of all consumers jointly taken.

The results consistency of the best-worst codification system has been checked. The results state that the best-worst coding system is consistent because results from the Exploded and Sequential Best-Worst models are identical.

The variance of the best and the worst options has been compared for multiattribute choice experiments. It is found that the worst options' variance is 46.4% higher than the variance of the best options.

Although all models state that consumers think that peaches with lowest quality are produced in other area (not from Calanda), without a Protected Designation of Origin, with smallest size (160g) and sold in active packing. However, peaches produced in the Calanda area, with PDO, weighing around 310g and not sold in active packing have the highest quality. The model with the simultaneous Best-Worst has been employed to estimate the interactions between late season peaches and consumers characteristics because it has produced parameters with highest statistical significance (accuracy).

It was found that all consumers have the same disutility when they have to change change medium size peaches (250g) to the smallest size (160g) based on marginal utilities measurements, for all sample and for some segments,; however consumers with different gender and age classes (older or younger than 50 years old) have different utilities when they have to select medium size from largest size (380g) peaches. Men and youngest consumers have greater utility with this exchange than women and the oldest, respectively.

Consumers are price sensitiveness to late season peaches and consumers segments' have difference price sensitivities. Thus, regular consumers, consumers with high loyalty toward PDO Calanda peaches, women, consumers with elementary education, consumers who are 50 years old or older and consumers who have less monthly household income than 1,500 Euros are those consumers who are less price sensitive and, consequently, they are more willing-to-pay for the product, which confirms that aged population are more ethnocentric.

As this choice experiment presents hypothetical purchases, consumers know that their statements do not have actual economic consequences for them, thus they tend to be less price sensitive, and their WTP also tend to be higher than their actual WTP. According to the WTP estimations, the price difference between peaches with the worst attribute-levels (lowest quality) and peaches with the best attribute-levels (highest quality) is 8.44€/kg. This overvaluation of peaches characteristics have been corrected by calculating a factor from the new choice experiment carried out in 2009.

In 2009, consumers stated the best and the worst levels for origin, packaging and peach size. Preferences toward these characteristics have been similar with the preferences found in 2008. They were also asked about their maximum WTP for a product with the best profile and other with the worst profile. For estimation purposes, it has been considered that consumers have the same utility between these two products. The results show that the average of the maximum WTP for peaches with the best profile is 2.21€/kg while this value for peaches with the worst profile is 1.05€/kg, i.e., a difference of 1.16€/kg.

It has not been possible to calculate these prices levels with the choice experiment of 2008. Thus, why the WTP from 2008 is considered? The justification is that the multiattribute choice experiment is more similar to a purchase situation and it has a greater number of comparisons than the choice experiment of 2009. In the survey of 2008 there are 9 purchase situations and each purchase situation is a trade off among the characteristic of 3 peaches whereas in 2009 only two peaches - with the highest and the lowest quality were evaluated.

The WTP of 2008 has been divided by 7.276 (8.44/1.16) to set the price range between peaches with the highest and lowest qualities. Based on these adjustments, it was estimated that PDO Calanda peaches consumers, on average, value the PDO Calanda 0.46€/kg, and they value peaches produced in Calanda area 0.35€/kg. Buying packaged peaches, without any treatments, have a WTP up to 0.10€/kg, but if the packing is active (with treatments that increase the storage period), it would be necessary to compensate the consumers with 0.15€/kg to maintain their original utility level (peaches conditioned in normal packing). To change peaches with the smallest size (160g) for other peaches with the most appreciated size (310g), consumers have a WTP of 0.20€/kg and to change peaches with the most appreciated size (310g) for peaches with the largest size (380g) they have to be compensated with 0.04€/kg to maintain the initial utility.

The variations of WTP, according to the kind of consumer, are displayed in Table 8.3. Consumers who are 50 years old or older are those who have greatest WTP for PDO Calanda peaches (0.78€/kg), for producing peaches in Calanda area (0.46€/kg), and for buying them in normal packing (0.20€/kg) – consumers with elementary education and consumers with household income below 1,500€/month have also the same WTP for peaches in normal packing, and changing peaches with the smallest size (160g) to other with most appreciated size (the most appreciated peach size weights 297g for oldest consumers), however they require highest compensations if packing is active (0.41€/kg) and if peaches weight changes from 297g to 380g (0.11€/kg).

Table 8.3 Consumers with highest and lowest WTP for late season peaches characteristics

	Highest value	Lowest value
- WTP for PDO Calanda	- 50 years old or older	- Sporadic consumers
- WTP for producing in the Calanda area	- 50 years old or older	- Sporadic consumers and with low or medium loyalty degree
- WTP for normal packing	- 50 years old or older; elementary education and household income below 1,500€/month	- Household income higher than 1,500€/month
- WTA for active packing	- Elementary education and household income below 1,500€/month	
- WTP for changing the smallest for the most appreciated size	- Elementary education and household income below 1,500€/month	- Sporadic consumers
- WTA for shifting the most appreciated to the largest size peaches	- Elementary education and household income below 1,500€/month	- Men and younger than 50 years old

Consumers who are less willing-to-pay for PDO Calanda peaches are the sporadic (0.28€/kg); for producing peaches in Calanda area are the sporadic and those with medium or low loyalty degree toward PDO Calanda peaches (0.27€/kg), for changing bulk peaches for peaches conditioned in normal packing are those consumers that have higher household income than 1,500€/month (0.08€/kg); sporadic consumers (0.14€/kg) for changing peaches of 160g for other peaches of the most appreciated size (307g for sporadic); and men are those who require the lowest compensation to change peaches of most appreciated size (325g for men) for others of 380g (0.02€/kg) and, men and people younger than 50 years old, for buying peaches in active and not in normal packing (0.12€/kg).

In this analysis there are two groups; one with old people, low household income and education level, which have higher WTP for optimum PDO Calanda peaches and have strong ethnocentric character, and another group with sporadic consumers and little attachment to PDO Calanda peaches.

8.B) At individual level

The previous described estimations have been carried out assuming that preferences are normally distributed across consumers. In order to verify if this condition is accomplished, preferences toward yellow peaches for each consumer have been estimated. The results from the Individual Utility Functions (IUF) state that there is a lack of normality on preference distribution, specially regarding for origins' levels.

The IUF have been estimated with different models. It has been found that the number of observations has a great impact on the number of parameters statistically significant, i.e., more accurate parameters are generated. Increasing the number of alternatives in each choice set increases significantly the number of parameters statistically different from zero. The Bottom-up model is the best model to estimate IUF because it has generated the greater number of parameters statistically different from zero and with higher accuracy than any other model.

Consumers' preferences for late season peaches have been described by the significance level of accepting or refusing the null effect hypothesis. It has been observed that assuming lower probability error, or greater statistic significance level, a smaller number of consumers have ciscriminated some late season peach characteristic and the number of characteristics that consumers use for their decisions also diminish.

At 10% of p-value, that is the highest risk level o error that the major part of empirical works assume, one third of consumers are indifferent among the late season peaches characteristics (the null hypothesis of marginal utility equals to zero of all parameters are accepted). In relation to the other consumers, two third have had (dis)utility with only one late season peach characteristic (attribute-level) while the rest of the consumers have had (dis)utility with two characteristics of the same attribute.

Of the 316 interviewed consumers in 2008, 210 (66.4%) have not been indifferent toward late season peaches characteristics. Of those consumers, 71.9% have considered peaches' origin on their decisions, 15.7% have taken into consideration any price level in their decisions, 6.2% for any kind of package and the rest (6.2%) for different peach size. All consumers who have differentiated origin levels have had positive utility with PDO Calanda peaches and/or negative utility with peaches producted outside the Calanda area. Similar things have happened with different peaches sizes, consumers only have positive utility with largest peaches (380g) and/or negative utility with the smallest size (160g). It means that consumers, besides given importance to origin and in particular to PDO Calanda, they assume a predetermined peach size for each origin.

In relation to the different types of packing, preferences are not so unanimous. In relation to the normal packing, 10 consumers have distinguished one kind of packing and 3 consumers have differentiated two kinds of packing. Regarding the first group, 60% of consumers have had negative utility with active packing but they are indifferent between bulk peaches and peaches conditioned in normal packing; 20% have had positive utility with active packing and present the same indifference than the first. That is, those consumers value positively the peach storage period and do not value the convenience aspect of packaging. The last 3 consumers have had positive marginal utility with bulk peaches and negative with active packing. It can be interpreted that consumers who do not like packing and their dislike increases if packing is active.

Price, besides considered a consumption limitation factor for household budgetary restrictions, it can also be a quality cue for some consumers. It was found that 18.2% of consumers, who considered price as the main late season peaches characteristic on their decisions have had positive utility with it, i.e., they think that there is an improvement when peaches of 2.5€/kg are changed for other peaches of 3.5€/kg.

It has been adopted a similar interpretation of preferences to classify and characterize consumers groups and subgroups. The classification has clustered consumers in 3 groups: consumers who are origin sensitive (151 consumers), those who are characterized of been sensitive toward origin levels; consumers who are sensitive for other attributes-levels (59 consumers), or those who distinguish some attribute-level but at same time they are indifferent between origin levels; and consumers who are indifferent among all attributes-levels (106 consumers), or those who are indifferent among all attributes-levels at 10% of p-value, at least. The differences between those 3 groups of consumers are described in Table 8.4.

Table 8.4 The most important differences among consumers groups classified according to their sensitiveness to late season peaches characteristics

Origin sensitive	Sensitive for other attribute-level	Indifferent
- 47.8% of consumers	- 18.7% of consumers	- 33.5% of consumers
- Greater proportion of elementary education level		
	- They give more importance to PDO Calanda peaches price and smell	
	- Less importance to the PDO Calanda peaches taste	- More importance to the PDO Calanda peaches taste
- They believe less that PDO Calanda peaches are more nutritive than other peaches	- They believe more that PDO Calanda peaches are more nutritive than other peaches	
- They give more importance to production in bags		- They give less importance to production in bags
- They agree more that production techniques of PDO Calanda peaches have positive effects on the environment		- They agree less that production techniques of PDO Calanda peaches have positive effects on the environment

The origin sensitive group is characterized for having greater proportion of consumers with elementary education than other groups, and it differentiates with respect the group sensitiveness toward other attribute-levels because consumers with agree less intensity that PDO Calanda peaches are more nutritive than other peaches; the origin sensitive differenciate from those consumers that are indifferent with all attributes-levels because they give more importance to the production of peaches in bags and they agree that PDO Calanda peaches production techniques are more beneficial to the environment. They have characteristics defined before for regular consumers with respect to PDO Calanda peaches. On the other hand, consumers who are sensitive to other attributes-levels are characterized to give more importance to the price and smell when they buy PDO Calanda peaches. They differentiate from those who are indifferent with all attributes-levels because they give less importance to PDO Calanda peaches taste on their purchase decisions and they also agree more to extend the PDO Calanda peaches offer season in November and December. The last two groups are differentiated one of each other for those attributes analysed previously which have intermediate importance, but with a different distribution, positive and negative, with respect taste.

For a more detailed analysis, the first group of consumers, the origin sensitive, has been divided into PDO Calanda brand buyers (88 consumers), who are those with positive utility with PDO Calanda peaches but they are indifferent between peaches produced in Calanda area and peaches produced in other area; production area buyers (15 consumers), who are those consumers who have positive utility with peaches produced in the Calanda area, but they are indifferent between peaches which have or have not PDO Calanda; and PDO Calanda brand and production area buyers (48 consumers), who are those consumers that have positive utilities with PDO Calanda peaches and with peaches produced in the Calanda area.

Table 8.5 describes the differences between the subgroups of origin sensitive consumers. It was observed that PDO Calanda buyers use to consume more peaches since their childhood. They differentiate production area consumers to given more importance to PDO Calanda peaches packaging and they distinguish PDO Calanda and production area buyers because they give more importance to price; although both subgroups purchase PDO Calanda peaches mainly in hyper/supermarkets, PDO Calanda brand buyers purchase more in markets and other places. The first subgroup can be considered closer to regular consumers whereas the third subgroup have the characteristics of ethnocentric consumers.

Production area buyers can also be characterized as consumers who go shopping PDO Calanda peaches more often in fruit stores and they give more importance to PDO Calanda peaches ripeness than PDO Calanda brand and production area buyers; by their also have higher household income (this subgroup has the lowest percentage of consumers with less household income than 1,500 Euros per month).

Table 8.5 Differences among subgroups of consumers, according to their late season peaches origin sensitivity

PDO Calanda brand buyers	Production area buyers	PDO Calanda brand and production area buyers
- 58.3% of origin sensitive consumers	- 9.9% of origin sensitive consumers	- 31.8% of origin sensitive consumers
- consume more peaches since their childhood		
	- Higher household income and purchase more often PDO Calanda peaches in fruit stores	
- Purchase more often PDO Calanda peaches in markets and other places		
- More importance to the PDO Calanda peaches packaging	- Less importance to the PDI Calanda peaches packaging	
- More importance to the PDO Calanda peaches price		- Less importance to the PDO Calanda peaches price
	- More importance to the PDO Calanda peaches ripeness	- Less importance to the PDO Calanda peaches ripeness

8.1.1.4 Relative importance and marginal utility measurement in a same scale

This work about consumers' preferences also deal with attributes-levels' marginal utilities and attributes' importance measurements in a common scale through the best-worst choice experiment of attributes and attributes-levels. In this choice experiment different peach profiles are shown to consumers. Profiles result from different combinations of price levels, origin-levels, packaging-levels and peaches size-levels. In each case, consumers stated the most and the least important attributes-levels (and at same time the attributes), which justified their late season peach purchase. Four approaches, resulting from the combination of estimation approaches such as Weighted Least Square (WLS) and Multinomial Logit (MNL) models, and analyses approaches such as Marginal and Paired, have been compared.

A strong relationship among these four approaches in previous works has been observed. However, in our study, it was found that the average differences between estimated parameters by Marginal analysis, calculated with WLS, are 1.1% higher than estimated parameters by Paired analysis, calculated with the same method, i.e., marginal as well as paired analysis calculated with WLS approaches generate parameters with similar values. However, the difference is 22.2% when both analyses are carried out with MNL. Thus, if preferences are estimated with WLS the decision of which kind of analysis is not as relevant as if the preferences are estimated with MNL.

A common result provided for all approaches has been that the importance of packaging, peach size and price are the same when consumers buy late season peaches. The only attribute that is significantly more important is the origin. Although there are not significant differences, results state that consumers consider the late season peaches sizes as the second most important attribute and they consider price as the least important attribute on their purchase.

Price is the fourth most important PDO Calanda peaches attribute and it is more important than PDO Calanda peaches size and packaging, but it is the least important late season peaches' attribute. This difference can be justified because consumers think that PDO Calanda peaches have higher prices at the market. However, the nature of the choice experiment may have had some influences on results; in one experiment the price importance is related to price levels while in other experiment it is not. In the experiment where attributes are presented without levels, each consumer may have his own interpretation of PDO Calanda peaches price levels.

The estimated utilities by the best-worst choice experiment of attributes and attributes-levels (survey of 2009), consumers have had greater utility with production area than PDO Calanda brand, whereas in the best-worst choice experiment of multiattributes (survey 2008), consumers have had greater utility with PDO Calanda brand than production area.

This difference may be attributed to the crisis that is affecting the Spanish economy. With the crisis, large retail chains have promoted their own brands and saving formats. The promotion of saving formats also may have affected preferences for different kinds of packaging. In 2008, when the crisis was at its beginning, consumers preferred peaches in normal packaging but in the following year, the preference changed to bulk peaches. However, the rejection against active packaging has remained.

Some differences on consumes' quality perceptions, between 2008 and 2009, have been occurred with respect peaches size. In 2008, consumers had higher utility with medium size peaches (250g) than with largest size peaches (380g) and this order changed in 2009. Probably, the fact that the ratio between flesh and stone has a positive relation with the peach size, consumers would prefer the largest peaches in order to save money when they purchase fruits and, perhaps, share the fruit with another person.

The next stage of Best-Worst choice experiment of attributes and attribute-levels data analysis has been to detect the heterogeneity on consumer preferences by the Mixed Logit model. Results indicate that, in relation to the price importance and origin importance of late season peaches, consumers' preferences are homogeneous, while the preferences are heterogeneous in relation to the importance of peaches size. The greatest preferences heterogeneity has been noticed with respct PDO Calanda peaches, largest peaches size (380g), active packaging, high price (3.6€/kg) and bulk peaches.

Models measuring the interaction effects between consumers' socio-economic and attitudes toward PDO Calanda peaches and late season peaches characteristics with preferences heterogeneity have been estimated to explain the preferences diversity. Consumers' ages (divided into two classes: older and younger than 50 years) and loyalty degree (high or not) neither have explained the utilities differences nor the different peach size importance.

In 2009, peach size assessment on consumers' choices can be explained by the PDO Calanda peaches consumption frequency, education levels, gender and household income. Regarding the previous year, there are a greater number of consumers' characteristics that interacts with peaches characteristics. This change is due to the different economic situations of 2008 and 2009.

In 2009, consumers with high household incomes (more than 1,500€/month) and consumers with low household income gave the same importance to the peach size. However, consumers with low household income had lower utility with peaches weighting 380g. As in one kilogram of largest peaches (380g) enter fewer pieces of fruit than in one kilogram of medium size peaches (250g), consumers with low income had less preference for peaches of 380g because they could diminish their purchase value. Savings may also explain why consumers with elementary education give greater importance to peaches size and less utility to peaches of 380g. In general, consumers with elementary education have also lower household income than those consumers with more education. Thus, in years with more strained economic conditions, the most appreciated peach size increases but there are less acceptance for largest size peaches.

Men have given more importance to the peach size than the women; however, in relation to marginal utilities associated with the three peach size levels (160g, 250g and 380g) there were not found significant differences between these two kind of consumers. Also in relation to consumers' gender, women have a greater negative utility to high price (3.6€/kg) and active packing than men.

8.1.2 Conclusions

This study has generated new information about consumers' stated preferences for peaches in Zaragoza city. The new information may guide the private sector in their market strategy in order to obtain higher profits; and the public sector may use the information to develop their policies to increase peach consumption. Academically, this work is based on different choice experiments to study consumer behaviour, using the best and the worst alternatives. The main conclusions of the work are:

a) Consumers differentiate peach quality by the attribute origin and they prefer a product with quality guaranty. The Protected Designation of Origin (PDO) Calanda, jointly with origin (Calanda) and quality control (PDO) is the most valuable attribute-level and the origin Calanda is the second most valuable level of the attribute origin for late season peaches for consumers from Zaragoza city. Taste is the most important PDO Calanda peaches attribute that justify its purchase and it is followed by ripeness. Thus, the generic brand (PDO Calanda) accomplishes its function of informing and ensuring peaches quality.

b) Although for some consumers the organoleptic quality (taste and smell) of PDO Calanda peaches has diminished in the last decades, the satisfaction with PDO Calanda peaches is high. However, sporadic consumers believe that PDO Calanda peaches taste can be improved.

c) Although PDO Calanda peaches size is the eighth most important attribute at purchasing when its levels are not specified to consumers (they assume certain levels), however peach size influence purchase significantly when different sizes options are offered. Small size peaches are less accepted in the market and, with certain limit, larger size is better. Not everybody is able to eat one largest size peach (380g) at once. Peach size has a strong visual attraction when people go shopping, but it is considered as a saving factor. On times of atrained economic situations, larger peaches are preferred because they can provide higher proportion of flesh to stone.

d) The majority of consumers prefer to eat a peach of large size by them selves at once. However, if the piece of fruit is too large, some consumers are willing to share the piece with another person and less often consumers store the fruit to finish eating it later. According to consumers’ preferences, the most appreciated peach size is around 310grams per fruit. Nevertheless, this size may vary for some consumers. Men and consumers who are younger than 50 years old wish larger peaches than women and older consumers, respectively.

e) Packaging has contributed to adapt the product to the modern consumer needs and wishes. However, consumer value packaging as the least PDO Calanda peaches attribute at purchasing places. As a consequence of the different economic situation between 2008 and 2009, consumers changed their preferences from a slight preference for normal packing peaches (consumers were statistically indifferent between normal parking and bulk peaches) to a stronger preference for traditional packaging (bulk peaches). Considering the objective quality, peaches conditioned in active packing have higher quality than peaches conditioned in normal packing, but consumers perceive it as opposite, they value positively the perishable feature of peaches because they associate it with freshness. In order to contribute on the market success of this technological innovation, it is necessary to make efforts to inform consumers that peaches do not lose its freshness and natural properties, because those features are not necessarily related to the eating deadline.

f) Consumers are sensitive to peach price and some consumers use it as a quality cue. There is a market segment that considers PDO Calanda peaches price as the most important attribute on their purchasing decisions, but most segments do not consider it as an important attribute. Regular consumers, consumers who have high loyalty toward PDO Calanda peaches, women, elementary education, consumers who are 50 years old or older and consumers with less household income of 1,500€/month are less sensitive to late season peaches price. There is ethnocentrism from a larger group of consumers with low household income and education which are more familiarised with PDO Calanda peaches.

g) As a consequence of the nature of the choice experiments, consumers have indicated little price sensitiviness and the estimations of the willingness-to-pay (WTP) have exceeded real prices found in the market. Therefore, it was necessary to correct the willingness to pay. The experiment, in which consumers indicate the best and the worst attribute-levels as well as their maximum WTP for the highest and for the lowest quality peaches, has been a good tool to adjust figures of WTP. The maximum WTP for peaches with the worst origin, without PDO, size and package is 1.05€/kg while the maximum WTP for peaches with the best features is 2.21€/kg.

h) The PDO Calanda brand is the greatest characteristic of late season peaches. In 2008, consumers from Zaragoza had a WTP of 0.46€/kg for PDO Calanda peaches instead those peaches from Calanda area without PDO, they had a WTP of 0.35€/kg to buy peaches produced in the Calanda area insted other peaches produced outside Calanda area; consumers had a WTP of 0.10€/kg to change peaches conditioned in active packing for bulk peaches; and of 0.20€/kg to shift peaches weighing 160g for others weighing 310g. In relation to normal packing, the value of active packaging rejection is 0.15€/kg and consumers are willing-to-accept (WTA) 0.04€/kg to change peaches of 310g to other peaches of 380g.

i) The statement of the worst alternative within the choice sets represents an additional information source for research. Introducing this kind of information in the analysis increases the estimated parameters accuracy and it has greater impact for the parameters accuracy of the least important attributes.

j) The responses variance of the worst options is greater than the responses variance of the best options. That is, consumers are closer in what they like, but they have greater divergence in what they dislike. This difference in variance depends on the kind of choice experiment. In the Best-Worst choice experiment of multiattributes, the variance difference between the best and the worst options is 46.1% whereas in the Best-Worst choice experiment of attributes this difference is 4.6% , i.e., the difference ranges up to 10 times depending on the type of choice experiment, with greater variation in those experiments with more detailed information.

k) The normal distribution of preferences is a basic assumption to estimate consumer average preferences with Multinomial Logit (MNL) models. Estimating individual utility functions (one utility function for each consumer), with the Bottom-up model, is found that this basic assumption is not accomplished. The preferences distribution of the different origin levels (from Calanda area with PDO and from other area without PDO), which are those attributes-levels that have provided the most extreme (dis)utilities, are the parameters who are more faraway from the normal distribution.

l) Consumers have been classified according to their estimated preferences by individual utility functions. They have been grouped according types of late season peaches characteristics, which they have distinguish (attributes and attribute-levels), and how they have valued this feature (positive or negative utility).

m) The Bottom-up model has the best fit than other tested models to estimate individual utility functions. It is the best model in a situation with few observations because it is able to generate a greater number of parameters statistically significant than other tested models. However, this model (Bottom-up) generates less accurate parameter and has the worst fit for estimations at sample level (all consumers together).

n) Measurement of the attributes' impacts and the marginal utility provided by the attribute-levels in a common scale, through Best-Worst choice experiment of attributes and levels of attributes, is an important analysis because although consumers have not distinguished attributes-levels, it is possible that a particular attribute is important on their choice decisions. Based on these results, the analyses of Marginal and Paired approaches generate the same parameters when they are estimated by Weighted Least Square (WLS) method. However, the estimated parameters by Marginal approach may have higher values than those parameters estimated by the Paired approach if the employed method is Multinomial Logit (MNL) model. Therefore, if the intention of the researcher is to make estimations at sample level, the most appropriate estimation method is the WLS because both analyical approaches give the same results.

8.1.3 Future research

Along this research, given the limitations of both time and resources, it was necessary to choose the most relevant aspects of consumers' preferences about late season peaches consumption as well as about the experimental design and analytical methods. The generated information with this study has contributed to improve understanding of consumers' behaviour of late season peaches, given emphasis to PDO Calanda peaches, in Zaragoza city, through the use of discrete choice experiments of the best and worst alternatives. Nevertheless, all this process can be ameliorated in the future.

The first suggestion is to extend this study to other locations. Our results are limited to consumers' preferences of Zaragoza city, which is a town near the area where the PDO Calanda peaches are produced. It has contributed to a greater appreciation of the PDO Calanda peaches brand and for peaches produced in the area of Calanda. In Spain, Madrid and Barcelona are the two locations where preferences should be verified. The consumer market of Madrid can be justified by its size, while the consumer market of Barcelona is relevant, in addition by the influence of its dimension, by its significant local production. Likewise, internationally, European markets are a priority because their proximity. Consumers, from traditionally fruit importing countries, with a large market such as Germany and England, could provide relevant information to Spanish peaches growers.

The adopted experimental design of multiattribute choice experiment only allows the estimation of attribute-levels main effects on purchasing decisions. Considering that consumers have rejected the active packaging, which is regarded as of inferior quality, and that PDO Calanda peaches enjoy high prestige among consumers, it would be important to measure the effect, if there exist, of the generic brand on such innovation rejection mitigation. To deal with this problem, future works should have an experimental design that measures the interactions effects between PDO Calanda brand and active packaging.

Peach growers spend a lot of resources to increase the fruit size. This paper has estimated the consumers' utility change when peach sizes vary, and it has reached conclusions about the most appreciated peach size by consumers. Additional information of marginal costs related to different peaches sizes could lead to more objective recommendations about the best peaches sizes for the industry to complement this result; therefore, it could increase the Spanish peaches sector competitiveness.

The stated preferences are discussed in this work. Compared to the actual preferences, stated preferences have certain advantages, such as to value the impact of technological novelties, as the active packaging innovation. However, the estimated values of WTP are higher than the current prices in the market. Because of the absence of actual preferences data, it was necessary to apply a new survey to weight previous estimated WTP. It is relevant to compare effectiveness of the weighting method with real preference data. If there is not sales data (scanner data is mostly used), questions about the last purchase of late season peaches could be incorporated in future questionnaires, because this information would be close to consumers' actual preferences.

The Best-Worst choice experiment specially serves to improve the least important attributes' parameters accuracy but the impact of the intermediate important attributes' parameters accuracy is small when estimating the attributes' importance. If it is considered that the most important as well as the least important attributes are easily identified by the peach sector, the attributes with intermediate importance may be useful for products differentiation. In this case, it is desirable that market research methods make greater reference to those attributes with intermediate importance, although the most important are crucial for communication.

The PDO Calanda peaches' attributes importance has been assessed verbally, i.e., the attribute names have been mentioned without giving any information about the attributes-levels to the consumer. For example, it has been asked about the relative importance of packaging and peach size on consumer purchase. In this comparison, each consumer could have their own interpretation of these parameters, and thus, providing more information about the attributes, could contribute to more accurate results.

The Best-Worst choice experiment of attributes measures the attributes relative importance and not their absolute importance. The 10 PDO Calanda peaches selected attributes for investigation have been chosen for their strategic importance and the assessment was qualitative. It would be interesting to include in the questionnaire of

2008 some assessment concerning the attribute absolute importance, for example, through a Likert scale with a closer reference about the attribute absolute importance.

Results of measuring attributes importance and of their levels utilities on the same scale have been successful because it generates relevant information for the research. However, it would be possible to take more benefit of the available data with a supplementary question in each choice set. This question would be related to peaches purchase and this additional information would also serve as a reference fot the obtained results.

Individual Utility Functions (IUF) have overcome some weaknesses of the preference estimations at sample level. The way how these estimations were analysed has yielded consistent results with other analysis that were carried out in this study. However, there are some aspects that could be improved. For example, it is necessary to investigate empirically and through simulations, the effect of a number of alternatives in each choice set and the number of choice sets that each consumer would have to answer, in order to have fewer indifferent consumers with respect the presented attribute-levels and that each consumer could distinguish more attributes-levels.

Up to now, the Bottom-up model has been employed for IUF estimations of multiattributes choice experiments. In future research the Bottom-up model could be used, for example, to estimate individual functions of attributes' relative importance. The attributes relative importance calculation, at individual-level, has been estimated by the difference between the number of times that the attribute has been chosen as the most important and the number of times it has been chosen as the least important (Best Worst Score - BWS). Calculating the BWS of each attribute does not take into account the scenarios in which the attribute has been chosen (which attributes were competing to be chosen by consumer), whereas this situation would be considered estimating individual functions.

Studying preferences of each consumer, by individual utility functions, seems to be a promising research area. This method of analysis still demands a lot of time because the available software is not adapted to this kind of study. This problem will be overcome once the advantages of the Bottom-up model in the preferences studies is better known and spread out.

8.2.1 Resumen

El objetivo principal de este trabajo ha sido estudiar las preferencias de los consumidores hacia los melocotones con Denominación de Origen Protegida (DOP) Calanda, en Zaragoza (España). Los melocotones DOP Calanda se ofertan en un corto periodo del año, entre la mitad de septiembre y el principio de noviembre, y su calidad diferenciada tiene una fuerte reputación, que es el principal factor que justifica su mayor disposición al pago por parte de los consumidores.

En un trabajo anterior se ha detectado que los consumidores están dispuestos a pagar mas por los melocotones con la DOP Calanda que por melocotones de parecidas características, pero sus informaciones han sido recogidas de los mayoristas que comercian con el producto. En este estudio, las informaciones sobre las preferencias han sido recogidas directamente de los consumidores, en la época de comercialización del producto en el mercado, por lo que sus respuestas podrían acercarse más a las preferencias reales.

En el inicio de este estudio (Capítulo 1), se hace una exposición del problema sobre el consumo y la producción frutas en general, y el melocotón en particular, en el mundo y en España. En España, los cambios socioeconómicos ocurridos en las últimas décadas han propiciado un cambio notable en los hábitos de consumo de alimentos. Cada vez menos personas siguen la dieta mediterránea, lo que asociado a un mayor sedentarismo, ha repercutido en la salud pública y en el bienestar de la población.

El segundo capítulo de la tesis está dedicado a la comprensión y elección de los principales parámetros de calidad del melocotón DOP Calanda. Para eso, se ha hecho primeramente una revisión bibliográfica, posteriormente se ha realizado un Focus Group, varias entrevistas con expertos y un seguimiento del mercado minorista del melocotón amarillo en Zaragoza, en el año 2008. Aunque no se hayan presentado los resultados, también se había realizado un seguimiento de precios del melocotón amarillo en 2009.

Como resultado de esta de investigación, 10 atributos de los melocotones DOP Calanda (sabor, color, precio, producción en bolsa, olor, tamaño de la fruta, tipo de envase, estado de maduración, pelusilla de la piel y su textura) con gran relevancia de mercado fueron seleccionados para el estudio de preferencia de los consumidores tal como las características diferenciadoras en la disposición marginal al pago. Estas características corresponden a 4 atributos con 3 niveles cada uno, que son: diferentes tipos de envase (a granel, en envase normal y en envase activo), tamaños de melocotón (pequeño, medio y grande), origen del melocotón (producido en la zona de Calanda pero sin la DOP Calanda, en la zona de Calanda con la DOP Calanda y en otra zona sin otra DOP) y precio. Se realizaron dos encuestas para la elaboración de este trabajo, una en 2008 y otra en 2009. Para la encuesta de 2008, los niveles de precio fueron: 1,5€/kg, 2,5€/k, y 3,5€/kg, y para la encuesta del año siguiente los niveles de precio fueron 1,2€/kg, 2,4€/kg y 3,6€/kg. Se ha mantenido los demás niveles de atributos en las dos encuestas.

En 2008 se encuestaron 316 consumidores y 212 en 2009. En ambos casos, los márgenes de error muestral han estado dentro de límites aceptables para este tipo de investigación (5,6% y 6,9%, respectivamente). Las dos encuestas han sido tratadas mediante análisis univariantes y bivariantes descritas en el tercer capítulo.

8.2.1.1 Los consumidores regulares de melocotón DOP Calanda

Los consumidores se agrupan en regulares y esporádicos. Los consumidores regulares constituyen las dos terceras partes de la muestra y son aquellos que comen melocotones DOP Calanda más de una vez a la semana durante su temporada de comercialización, mientras que los esporádicos son los que consumen con menor frecuencia. Las características diferenciales de los consumiodores regulares de melocotón DOP Calanda se recogen en la Tabla 8.6.

Según los datos de las encuestas, los consumidores regulares se caracterizan por ser individuos con mayor edad, un nivel de educación bajo, una mayor proporción que se dedican a las actividades del hogar a tiempo completo y que tienen menor ingreso familiar que los consumidores esporádicos. También están más acostumbrados a comer melocotones desde su infancia y creen más ser capaces de reconocer la calidad del melocotón cuando lo compran.

Los consumidores regulares están más en desacuerdo con la afirmación de que ellos prefiren melocotones envasados por la escasez de tiempo para realizar las compras. Esta actitud se explica porque estos consumidores son en mayor medida personas jubiladas y por eso tienen más tiempo de realizar las compras. Otra limitación al consumo de melocotones envasados por este grupo de consumidores es el tiempo de almacenatimento del producto en su casa. Los consumidores regulares consumen antes el melocotón DOP Calanda que los esporádicos.

A principio, por escacez de tiempo y por el periodo de almacenamento del melocotón, los consumidores esporádicos demandarían más melocotones envasados, en especial los que están en envases activos. No obstante, ellos creen más que el melocotón envasado tiene alguna consecuencia negativa para la salud. Su percepción sobre la calidad organoléptica de los melocotones envasados también es peor, pues creen en mayor medida que el envase afecte al sabor o el olor de la fruta. Para aumentar su aceptación del producto hace falta programas de información sobre las consecuencias a la salud y sobre la calidad organoléptica del melocotón envasado.

Aunque todos los consumidores se declaran satisfechos con el sabor del melocotón DOP Calanda, a diferencia de los consumidores regulares, los esporádicos creen que su sabor es mejorable.

Tabla 8.6 Caracteristicas diferenciales de los consumidores regulares del melocotón DOP Calanda

Tipo de característica	Su particularidad
- Socio-económicas	- Con mayor edad; educación baja; dedican más tiempo a su casa; ingresos familiares bajos
- Hábitos de consumo	- Mayor proporción de consumidores desde su infancia; reconocen mejor la calidad del melocotón
- Actitud hacia el Melocotón DOP Calanda	- Más satisfechos con la calidad; desean más la ampliación de su oferta; son más etnocéntricos; son más fieles al melcotón DOP Calanda; los consumen en menor espacio de tiempo; piensan que son más sanos; contaminan menos; dan más importancia al uso de bolsas en su producción; y están menos conformes con que sean más nutritivos
- Actitud hacia el uso de envases	- Perciben un menor riesgo para la salud, asi como a los cambios de sabor y olor; no sienten la necesidad de comprarlos por la escacez de tiempo para realizar las compras

Con respeto a las valoraciones del melocotón DOP Calanda, los consumidores regulares presentan una actitud más etnocéntrica que los esporádicos porque piensan, en mayor medida, que la compra de melocotón DOP Calanda impediría la entrada de melocotones de otras zonas y, por eso, se beneficiarían con el fomento de la economía regional. También opinan que los melocotones DOP Calanda, dadas sus técnicas propias de producción, contaminan menos el medio ambiente, son más sanos e incluso son algo más nutritivos que los demás melocotones. En general, todos los consumidores quieren que el periodo de oferta del melocotón DOP Calanda sea ampliado, aunque los consumidores regulares se muestran mas abiertos a este cambio. Ambos grupos de consumidores se muestran indiferentes entre que la oferta se anticipada o retardada.

Otra diferencia entre los consumidores regulares y esporádicos es el grado de fidelidad hacia el melocotón DOP Calanda. El grado de fidelidad ha sido medido, de forma espontánea (encuesta 2008) y sugerida (encuesta 2009), mediante su apetencia a otras frutas sustitutivas al melocotón DOP Calanda. Los consumidores han sido clasificados de baja, media y alta fidelidad. Los de baja fidelidad son los que elegirían un producto similar al melocotón DOP Calanda, es decir, otro melocotón; los de media fidelidad son los que elegirían otra fruta de hueso, por ejemplo la nectarina o la pavía, y los de alta fidelidad son los que elegirían otra fruta que no fuera de hueso. Los resultados enseñan que las respuestas sugeridas tienden a un menor grado de fidelidad. El 30% de los consumidores tienen baja fidelidad, el 20% son medianamente fieles y el 50% de los consumidores son altamente fieles al producto. Los consumidores regulares son más fieles hacia el melocotón DOP Calanda que los esporádicos. El 72,7% de los consumidores regulares tiene alta fidelidad mientras que este porcentaje es del 57.7% para los consumidores esporádicos.

8.2.1.2 Importancia relativa de los atributos del melocotón DOP Calanda

La importancia relativa de los atributos del melocones DOP Calanda en las decisiones de compras ha sido medida por medio de un experimento de elección llamado Mejor-Peor. En este experimento los consumidores tuvieron que señalar el mejor atributo o el más importante y el peor atributo o el menos importante, entre 4 opciones de atributos, que influencian sus decisiones de compra. Este tipo de experimento fue utilizado porque los consumidores comparan la importancia entre los atributos, están forzados a elegir una opción u otra, y por eso, discriminan mejor la importancia de los atributos. Además, este método evita sesgos de comportamiento debido al uso de escalas.

Las respuestas de los consumidores han sido analizadas empleando dos aproximaciones, una es la puntuación de Mejor-Peor (Best-Worst Score o BWS) y la otra por medio de la función multinomial (MNL). Con la primera aproximación (BWS), el orden de importancia, del más importante al menos, de los 10 principales atributos del melocotón DOP Calanda son: sabor, grado de madurez, olor, color, precio, textura, producción en bolsas, tamaño del melocotón, pelusilla de la piel y, por último, tipo de envase. Aunque el color es más importante que el precio y el precio más importante que la textura, las diferencias son tan pequeñas que estadísticamente el grado de importancia es similar entre ellas. La misma observación se puede hacer entre la importancia de la producción en bolsas y el tamaño del melocotón, en cuanto a la significación estradística.

Se han detectado correlaciones significativas de puntuaciones de Mejor-Peor entre diferentes atributos, y los mismos fueron agrupados en 5 factores. Un factor agrupa por la importancia del sabor y el estado de maduración, el segundo por la importancia del olor y del precio, el tercero por el color y el tipo de envase, el cuarto factor por la textura y el tamaño de la fruta y, el último, por la importancia de la producción en bolsas y la pelusilla del la piel del melocotón.

El ordenamiento de los atributos por su grado de importancia calculados por la función MNL ha sido muy parecido al obtenido por el BWS. La única diferencia es que el precio ocupa la 5ª posición y el color la 4ª posición, en el BWS, mientras que este orden cambia en la estimación multinomial. Considerando que la diferencia de importancia de estos dos atributos, calculados por BWS, no son estadísticamente significativas, se puede decir que los resultados de estos dos métodos son equiparables.

Se han valorado los resultados obtenidos por la función MNL atendiendo solamente a un tipo de opción: o la mejor (más importante) o la peor (menos importante) opción. Cuando las preferencias son evaluadas exclusivamente con las mejores opciones, hay una sobreestimación de la importancia de los atributos menos importantes y, si las estimaciones son realizadas solamente con las peores opciones, las importancias de los atributos más importantes son subestimadas. Las mejores estimaciones son obtenidas cuando los dos tipos de opciones son consideradas a la vez porque hay un incremento de la precisión del valor estimado de la importancia de los atributos más y menos importantes.

También se ha estimado la varianza de las respuestas de los consumidores sobre los atributos más y menos importantes. De media, las opciones menos importantes tienen una varianza 4,6% superior a la varianza de las opciones más importantes. Eso significa que hay una mayor unanimidad, o homogeneidad, de las preferencias para los atributos más importantes que para los atributos menos importantes.

La heterogeneidad de las preferencias ha sido estudiada por medio de dos métodos: por el test de Mann-Whitney, que contrasta el ordenamiento de la importancia de los atributos entre distintos grupos de consumidores, y por la estimación de Clases Latentes. Los consumidores han sido agrupados según sus características socio-económicas y sus actitudes. Las diferencias de importancia de los atributos, por tipo de consumidor, están resumidas en la Tabla 8.7.

Tabla 8.7 Atributos del melocotón DOP Calanda con diferentes importancias según el tipo de consumidor

Tipo de importancia	Tipo de consumidor
- Más importancia al precio	- Alta fidelidad
- Menos importancia a la pelusilla de la piel	- Alta fidelidad y con 50 años o más
- Más importancia al sabor	- De 35 hasta 50 años, universitarios e ingreso familiar superior a los 3.000€/mes
- Más importancia al tipo de envase	- Ingreso familiar igual o inferior a 900€/mes y educación elemental
- Más importancia al estado de maduración	- Universitários
- Menos importancia al tamaño del melocotón	- De 50 hasta 65 años
- Más importancia al embolsado	- De 50 años o más

En relación a los consumidores con baja fidelidad hacia el melocotón DOP Calanda, los consumidores con alta fidelidad dan más importancia al precio y menos a la pelusilla de la piel del melocotón. Los consumidores que dan más importancia al sabor de los melocotones DOP se caracterizan por ser individuos con edad entre 35 y 50 años, con educación universitaria y con ingreso familiar más alta que 3.000 euros mensuales. Las personas con ingreso familiar más alto (más de 4.000 euros por mes) dan menos importancia al tipo de envase, mientras que las personas de ingreso familiar más baja (inferior a 900 euros por mes) son las que le atribuyen a este atributo la mayor importancia. Los consumidores con ingreso familiar inferior a 900 euros por mes también son los que dan menor importancia al estado de maduración del melocotón DOP Calanda. El estado de maduración también es más valorado por los consumidores con estudios universitarios que los que tienen estudios elementales. Los consumidores con estudios elementales además dan más importancia al tipo de envase que los universitarios. La importancia de que se produzca el melocotón DOP Calanda en bolsas es mayor para los individuos a partir de los 50 años. Los consumidores con mayor edad dan menos importancia a la pelusilla de la piel del melocotón, pero dan más importancia al tamaño que los consumidores con edades entre 50 y 65 años, que son los que menos importancia dan al tamaño del melocotón.

También se ha constatado que los consumidores regulares se diferencian de los esporádicos solamente por dar más importancia a la producción de los melocotones DOP Calanda en bolsas (Esta información está relacionada en la Tabla 8.6).

Los consumidores han podido ser agrupados en 5 clases atendiendo al grado de importancia que los atributos del melocotón DOP Calanda tienen para ellos. El grupo más numeroso (Clase 1), agrupa al 27,8% de los consumidores, y valoran los atributos con la valoración media del conjunto de los consumidores. El segundo grupo más numeroso (Clase 4) agrupa al 22,3% de los consumidores y se caracteriza por considerar el precio como el segundo atributo menos importante y, comparado con los demás grupos, dan más importancia al tamaño del melocotón DOP Calanda. Los consumidores de la Clase 2 (16,0%) se diferencian de los demás porque consideran el precio como el atributo más importante en sus compras. Los consumidores de la Clase 5 (15,3%) consideran el precio como el segundo atributo más importante y se diferencian de los consumidores de la Clase 2 por dar más importancia a la producción en bolsas y al color del melocotón. En esta desagregación sobresale el papel diferenciador, en los distintos grupos, que tienen los atributos de importancia media, al principio señalado con las aproximaciones BWS y MNL. El precio juega un papel importante en 3 de los grupos obtenidos.

8.2.1.3 Importancia de los niveles de los atributos del melocotón tardío

En esta sección se reflejan los resultados del melocotón tardío, es decir, al melocotón que se comercializa en la última parte de la campaña y que abarca mucho mayor volumen que el melocotón DOP Calanda. Este análisis ha sido dividido en dos partes, una parte se refiere al estudio de las preferencias de los consumidores al nivel de muestra (preferencias medias son estimadas por grupos de consumidores) y otra parte que estudia las preferencias al nivel individual (se estima la preferencia de cada consumidor separadamente).

8.A) Al nivel de muestra

Se ha realizado un experimento de elección discreta de multiatributos usando la metodología de Mejor-Peor en la encuesta del 2008. En este experimento cada opción resulta de diferentes combinaciones de niveles de atributos que conforman perfiles hipotéticos de melocotones. Los consumidores indicaron el mejor y el peor melocotón y su deseo de comprar el mejor melocotón. Con los datos proporcionados a partir de este experimento se ha estimado la utilidad marginal entre las distintas características del melocotón tardío. También se ha comparado la eficiencia de los diferentes modelos de estimación.

Los resultados obtenidos apuntan que, con solamente las mejores opciones, el modelo de elección condicionado, es decir, aquel en el que el consumidor no tiene la opción de no compra (*status quo*), ha tenido mejor ajuste (CAIC más bajo) que el modelo no condicionado, cuando el consumidor tiene la opción de no compra, y la precisión de los parámetros (utilidades marginales) en ambos casos es muy parecida.

Se ha valorado el efecto del aumento del número de observaciones con la incorporación de las peores opciones. La duplicación del número de observaciones ha disminuido el poder de explicación de la varianza de los modelos (ha bajado el R^2 ajustado en todos los modelos) y ha empeorado el ajuste del modelo (ya que ha aumentado el CAIC), pero ha aumentado la precisión (el nivel de significancia) de los parámetros estimados. El incremento del número de alternativas en el conjunto de elecciones también ha aumentado la precisión de los parámetros y la explicación de la varianza de las elecciones, pero ha repercutido negativamente en el ajuste de los modelos.

El modelo Bottom-up, que aumenta considerablemente el número de observaciones y el número alternativas en los conjuntos de elección, ha presentado el peor ajuste (R^2 ajustado y CAIC). Aunque casi todos los parámetros presentaron significancia estadística, las estimaciones de los parámetros han sido las menos precisas que la precisión de otros modelos. Por eso, se considera el modelo Bottom-up como el peor modelo para estimar las preferencias medias de todos los consumidores conjuntamente.

Se ha contrastado la consistencia de los resultados ofrecidos por el sistema de codificación de las mejores y las peores opciones. Los resultados apuntan que el sistema de codificación de mejor y peor opción es consistente porque los resultados del modelo explosionado y del Mejor-Peor Sequencial han sido idénticos.

Las varianzas de los mejores y las peores opciones se han contrastado para el experimento de multiatributos han sido contrastadas. Se ha detectado que la varianza de las peores opciones es un 46,4% superior a la varianza de las mejores opciones.

Aunque todos los modelos indiquen que los consumidores consideran que el melocotón de peor calidad se producido fuera de la zona de Calanda, sin una Denominación de Origen Protegida, del tamaño más pequeño (160g) y son vendidos en envases activos, y que el melocotón de la más alte calidad se produce en la zona de Calanda, con Denominación del Origen Protegida, con un peso aproximado de 310g y no vendido en envases activos, el modelo 5 (modelo de Mejor-Peor simultáneo) ha sido empleado para estimar las interacciones entre las características del melocotón tardío y los consumidores porque ha producido parámetros con más significancia estadística (precisión).

A partir de las medias de utilidades marginales, para toda la muestra y para determinados segmentos, se ha constatado que todos los consumidores tienen las mismas disutilidades al intercambiar un melocotón mediano con uno de tamaño más pequeño (160g), pero los consumidores de diferentes géneros y clases de edad (mayores o menores de 50 años) tienen diferentes utilidades al intercambiar un melocotón mediano con un melocotón del tamaño más grande (380g). Los hombres y los más jóvenes tienen más utilidad con esta permuta que las mujeres o los más mayores, respectivamente.

Los consumidores son sensibles al precio del melocotón tardío en sus compras y los segmentos de consumidores tienen diferentes sensibilidades al precio. Así, los consumidores regulares, los que tienen un alto grado de fidelidad hacia el melocotón DOP Calanda, las mujeres, los consumidores con educación elemental, los consumidores con 50 años o más y los que tienen unos ingresos familiares inferiores a los 1.500 euros mensuales son los menos sensibles al precio y, consecuentemente, los que tienen mayor disposición a pagar por el producto, confirmando el etnocentrismo de la población de cierta edad.

Por tratarse de experimentos de compras hipotéticas, los consumidores saben que sus elecciones no tienen una implicación económica real, por eso ellos tienden a ser poco sensibles al precio, y las estimaciones de las disposiciones a pagar tienden a ser superiores a las reales. Según las estimaciones de disposición al pago, la diferencia de precio entre el melocotón con los peores niveles de atributos (de baja calidad) y el melocotón con los mejores niveles de atributos (de alta calidad) es de 8,44€/kg. Esta sobrevaloración de las características del melocotón ha sido corregida por un factor calculado a partir de un nuevo experimento de elección llevado a cabo en el año 2009.

En el experimento de 2009, los consumidores indicaron los mejores y los peores niveles de origen, tipo de envase y tamaño de un melocotón. Las preferencias por estas características han sido muy similares a las preferencias del año 2008. Se preguntaba también la máxima disposición a pagar por un producto con las mejores características y por un producto con las peores características. Para las estimaciones, se considera que los consumidores tienen la misma utilidad entre estos dos productos. Los resultados indican que la media de la máxima disposición a pagar por el melocotón que reúne las mejores características ha sido de 2,21€/kg mientras que por el melocotón con las peores características ha sido de 1,05€/kg, es decir, una diferencia de 1,16€/kg.

Estos niveles de precios no han sido posibles de ser calculados con el experimento de elección del año 2008. Entonces, ¿por qué se ha usado las disposiciones a pagar del año 2008? La justificación es que el experimento de elección de multiatributos se asemeja más a una situación de compra y también hay un mayor número de comparaciones que en el experimento del 2009. En la encuesta del 2008 hay 9 situaciones de compra y en cada situación de compra se comparaban 3 melocotones con características diferentes mientras que en el 2009 se han valorado solamente dos melocotones – de alta y de baja calidad.

Para ajustar la amplitud de precios entre el melocotón con la mejor y peor calidad, se han dividido las disposiciones a pagar del año 2008 por el factor 7,276 (8,44/1,16). Con estos ajustes, se ha estimado que los consumidores de melocotón DOP Calanda en Zaragoza valoran la DOP Calanda en 0,46€/kg, de media, y la zona de Calanda en 0,35€/kg. Para comprar el melocotón en envases sin tratamientos están dispuestos a desembolsar hasta 0,10€/kg, pero si el envase es activo (que lleva tratamientos y aguantan más tiempo de conservación) tendrían que ser compensados en 0,15€/kg para tener el mismo nivel de utilidad original (melocotón envasado normal). Para cambiar un melocotón más pequeño (160g) por uno del tamaño más apreciado (310g) pagarían 0.20€/kg y tendrían que ser compensados en 0.04€/kg para cambiar un melocotón de tamaño más apreciado (310g) por otro mayor de 380g.

Las variaciones de la disposición a pagar, según el tipo de consumidor, están recogidas en la Tabla 8.8. Los consumidores con 50 años o más son los que presentan mayor disposición a pagar por la DOP Calanda (0,78€/kg), para que el melocotón sea producido en la zona de Calanda (0,46€/kg), para tenerlos en envase (0,20€/kg) – los consumidores con educación elemental e ingresos familiares inferiores a 1.500€/mes también tienen la misma disposición a pagar por el melocotón en envase normal, para intercambiar un melocotón de 160g por otro del tamaño más deseado (el melocotón de tamaño optimo para ellos es de 297g), pero son los que exigen una mayor compensación si el envase es activo (0,41€/kg) y si el melocotón es de 380g (0,11€/kg).

Tabla 8.8 Consumidores con mayores y menores disposición a pagar por característica del melocotón tardío

	Valor más alto	Valor más bajo
- Disposición a pagar por la DOP Calanda	- Con 50 años o más	- Consumidores esporádicos
- Disposición a pagar por la producción de la zona de Calanda	- Con 50 años o más	- Consumidores esporádicos y con fidelidad baja o media
- Disposición a pagar por el envase normal	- Con 50 años o más, educación elemental e ingresos familiares inferiores a 1.500€/mes	- Ingresos familiares superiores a 1.500€/mes
- Disposición a ser compensado por el envase activo	- Educación elemental e ingresos familiares inferiores a 1.500€/mes	
- Disposición a pagar para cambio del tamaño más pequeño al apreciado	- Educación elemental e ingresos familiares inferiores a 1.500€/mes	- Consumidores esporádicos
- Disposición a ser compensado por el cambio del tamaño más apreciado al más grande	- Educación elemental e ingresos familiares inferiores a 1.500€/mes	- Los hombres y los menores de 50 años de edad

Los consumidores que están menos dispuestos a pagar por la DOP Calanda son los esporádicos (0.28€/kg); por la producción en la zona de Calanda son los esporádicos y con bajo o medio nivel de fidelidad al producto (0,27€/kg); para intercambiar melocotones a granel por el envase normal son los consumidores que tienen un ingreso familiar superior a 1.500€/mes (0,08€/kg); para cambiar un melocotón de 160g por uno con el tamaño más apreciado (307g para los esporádicos) son los esporádicos (0,14€/kg); y los hombre son los que exigem menor compensación por cambiar el melocotón con el tamaño más deseado (325g – para los hombres) por el de 380g (0,02€/kg) y, los hombres y los menores de 50 años, por comprar un melocotón en envase activo y no en envase normal (0,12€/kg).

En este analisis sobresalen dos grupos, uno conformado por gente mayor, de bajos ingresos y educación, que tienen una mayor disposición a pagar por óptimos melocotones DOP Calanda y con un marcado carácter etnocéntrico, y un grupo de consumidores esporádicos con muy poco apego al melocotón DOP Calanda.

8.B) Al nivel individual

Las estimaciones anteriormente descritas son realizadas asumiendo que las preferencias tienen una distribución normal entre los consumidores. Para verificar si esta condición se cumple, se ha estimado las preferencias de cada consumidor por el melocotón tardío. Los resultados de las Funciones de Utilidad Individuales (FUI) indican que no hay distribución normal de las preferencias, especialmente en relación con los niveles de origen.

Se han estimado las FUI con diferentes modelos. Se ha observado que el número de observaciones tiene un gran impacto en la generación de parámetros estadísticamente más significativos, es decir, se generan parámetros con mayor precisión. El aumento del número de alternativas en cada conjunto de elección genera un aumento significativo en el número de parámetros estadísticamente diferente de cero. El mejor modelo para estimaciones de las FUI ha sido el Bottom-up porque ha generado el mayor número de parámetros estadísticamente significativos y con mayor precisión que cualquier otro modelo.

Las preferencias de los consumidores hacia el melocotón tardío han sido descritas al considerar un nivel de significancia para aceptar o rechazar la hipótesis de efecto nulo. Se ha observado que asumiendo menores niveles de probabilidad de error, o a mayor nivel de significancia estadística, un menor número de consumidores han discriminado alguna característica del melocotón tardío y el número de características que los consumidores basan sus decisiones también disminuye.

Al 10% de p-value, que es el mayor nivel de riesgo o error que la mayoría de los trabajos empíricos asumen, un tercio de los consumidores son indiferente entre las características del melocotón tardío (se acepta la hipótesis nula de utilidad marginal igual a cero en todos los parámetros). De los demás consumidores, dos tercios han tenido (dis) utilidad solamente con una característica del melocotón tardío y el resto con dos características del mismo atributo.

De los 316 consumidores entrevistados en el 2008, 210 (66,4%) no se han mostrado indiferentes con las características del melocotón tardío. El 71,9% han considerado el origen del melocotón en sus decisiones, el 15,7% se han basado en algún nivel de precio, el 6.2% por algún tipo de envase y el resto (6.2%) por diferentes tamaños del melocotón. Todos los consumidores que han diferenciado los niveles de origen han tenido utilidad positiva con la marca de melocotones DOP Calanda y/o utilidad negativa con la producción fuera de la zona de Calanda. Lo mismo ha ocurrido con los distintos tamaños de melocotón, ya que los consumidores solamente han tenido utilidad con los melocotones más grandes (380g) y/o utilidad negativa con el tamaño más pequeño (160g). Lo cual indica que los consumidores además de dar gran importancia al origen, y en particular a la DOP Calanda, asumen un tamaño determinado de melocotón para cada origen.

En relación a los diferentes tipos de envase, las preferencias no son tan unánimes. En total, 10 consumidores han distinguido un tipo de envase con respeto al envase normal y 3 consumidores han diferenciado dos tipos de envase diferentes al envase normal. Del primer grupo, el 60% han tenido utilidad negativa con el envase activo pero son indiferentes entre el envase normal y el melocotón a granel; el 20% tiene utilidad positiva con el envase activo y presentan la misma indiferencia que los primeros. Es decir, estos consumidores valoran positivamente el tiempo de almacenamiento del melocotón y no valoran los aspectos de conveniencia de los envases. Los últimos 3 consumidores han tenido utilidad marginal positiva con el melocotón a granel y negativa con el envase activo. Es decir, a estos consumidores no les gusta el envase y menos si el envase es activo.

El precio, además de ser un factor que limita el consumo por las restricciones presupuestarias de la familia, puede ser un indicador de calidad para algunos consumidores. El 18,2% de los consumidores que han tomado el precio como la principal característica del melocotón tardio en sus decisiones han tenido utilidad positiva, es decir, hubo mejora al cambiar un melocotón de 2,5€/kg por otro de 3,5€/kg.

Una interpretación similar de las preferencias se ha adoptando para la clasificación y caracterización los consumidores en grupos y subgrupos. La clasificación ha agrupado los consumidores en 3 grupos: los sensibles al origen (151 consumidores), que son aquellos que no son indiferentes entre algún nivel de origen; los consumidores sensibles a otro nivel de atributo (59 consumidores), que son aquellos que han distinguido algún nivel de atributo pero son indiferentes entre los niveles de origen; y los consumidores indiferentes a todos los niveles de atributos (106 consumidores), que son aquellos consumidores que son indiferentes entre todos los niveles de atributos a un nivel de p-value del 10% o menos. Las diferencias entre estos tres grupos de consumidores están descritas en la Tabla 8.9.

El grupo de consumidores sensibles al origen se caracteriza por tener una mayor proporción de individuos con educación elemental que los demás grupos, y se diferencian en relación a los consumidores sensibles a otro nivel de atributo porque están menos de acuerdo con que el melocotón DOP Calanda sea más nutritivo que los demás melocotones; los sensibles al origen se diferencian de los consumidores indiferentes a todos los niveles de atributos porque dan más importancia al embolsado del melocotón y están más de acuerdo con que las técnicas diferenciadas de producción del melocotón DOP Calanda son más beneficiosas al medio ambiente. Tienen características antes definidas para los consumidores regulares de melocotón DOP Calanda. Por otro lado, los consumidores que son sensibles a otro nivel de atributo se caracterizan por ser los que más importancia dan al precio y al olor del melocotón cuando compran el melocotón DOP Calanda. Ellos se diferencian de los consumidores que son indiferentes a todos los niveles de atributos porque dan menos importancia al sabor del melocotón DOP Calanda en sus decisiones de compra y también son los que están más de acuerdo con que se amplíe la temporada de oferta del melocotón DOP en los meses de noviembre y diciembre. Estos dos últimos grupos se mueven más por las diferencias de los atributos intermedios de los análisis hechos anteriormente, salvo una distribución diferenciada, en positivo y negativo, con respeto al sabor.

Tabla 8.9 Diferencias más importantes entre los grupos de consumidores clasificados según su sensibilidad a las características del melocotón tardío

Sensibles al origen	Sensibles a otro nivel de atributo	Indiferentes a todos los niveles de atributos
- El 47,8% de los consumidores	- El 18,7% de los consumidores	- El 33,5% de los consumidores
- Mayor proporción de educación elemental		
	- Confieren más importancia al precio y al olor del melocotón DOP Calanda	
	- Menor importancia al sabor del melocotón DOP Calanda	- Mayor importancia al sabor del melocotón DOP Calanda
- Cren menos que el melocotón DOP Calanda sea más nutritivo que los demás	- Cren más que el melocotón DOP Calanda sea más nutritivo que los demás	
- Mayor importancia al embolsado del melocotón DOP Calanda		- Menor importancia al embolsado del melocotón DOP Calanda
- Están más de acuerdo con que las técnicas de producción del melocotón DOP Calanda tenga un efecto beneficioso con el medio ambiente		- Menor acuerdo con que las técnicas de producción del melocotón DOP Calanda tenga un efecto beneficioso con el medio ambiente

Para un análisis más detallado, el primer grupo de consumidores, los sensibles al origen, ha sido dividido entre los consumidores compradores de la marca DOP Calanda (88 consumidores), que son los que tienen utilidad positiva con la DOP Calanda pero son indiferentes entre melocotones producidos en la zona de Calanda u otra zona de producción; consumidores compradores de melocotones por su zona de producción (15 consumidores), que son aquellos que tienen utilidad positiva con los melocotones producidos en Calanda, pero son indiferentes si los melocotones tienen o no la DOP Calanda; y en consumidores compradores de la marca DOP Calanda y zona de producción (48 consumidores), que son aquellos consumidores que tienen utilidad positiva que la marca DOP Calanda y con los melocotones producidos en la zona da Calanda.

La Tabla 8.10 describe las diferencias entre los subgrupos de consumidores sensibles al origen. Se ha observado que los consumidores compradores de marca genérica son los que consumían melocotones desde su infancia. Se diferencian de los consumidores compradores de melocotones por su zona de producción, por dar más importancia al tipo de envase del DOP Calanda y se distinguen de los consumidores que compran el melocotón por la marca DOP Calanda y por su zona de producción por dar más importancia al precio; aunque los dos subgrupos compran el melocotón DOP Calanda básicamente en hiper/supermercados, los que consideran solamente con marca compran más en mercadillos u otros lugares. El primer subgrupo está cercano a los consumidores regulares mientras que el tercer subgrupo tiene las características de consumidores etnocéntricos.

Los consumidores que compran el melocotón por su zona de producción se caracterizan por tener unos ingresos familiares más altos (tienen el menor porcentaje de consumidores con ingresos familiares inferiores a 1.500 euros por mes), son los que más compran el melocotón DOP Calanda en fruterías y dan más importancia al estado de maduración del melocotón DOP Calanda, que los consumidores que compran por la marca DOP Calanda y por la zona de producción del melocotón.

Tabla 8.10 Diferencias entre los subgrupos de consumidores, según sus sensibilidades al origen del melocotón tardío

Compradores de La marca DOP Calanda	Compradores de El origen Calanda	Compradores de La marca DOP Calanda y El origen Calanda
- El 58,3% de los consumidores sensibles al origen	- El 9,9% de los consumidores sensibles al origen	- El 31,8% de los consumidores sensibles al origen
- Consumen más melocotones desde su infancia		
	- Mayores ingresos familiares y compran más el melocotón DOP Calanda en fruterías	
- Compran más melocotonones DOP Calanda en mercadillos y otros lugares		
- Mayor importancia al tipo de envase del melocotón DOP Calanda	- Menor importancia al tipo de envase del melocotón DOP Calanda	
- Mayor importancia al precio del melocotón DOP Calanda		- Menor importancia al precio del melocotón DOP Calanda
	- Mayor importancia al estado de maduración del melocotón DOP Calanda	- Menor importancia al estado de maduración del melocotón DOP Calanda

8.2.1.4 Medición de la importancia relativa y utilidad marginal en una misma escala

Este trabajo de las preferencias de los consumidores también ha medido la utilidad marginal de los niveles de atributos y la importancia de los atributos en una escala común a través del experimento de Mejor-Peor de atributos y niveles de atributos. En este experimento de elección se ha presentado a los consumidores diferentes perfiles de melocotones, resultantes de la combinación de los distintos niveles de precio, origen, tipos envase y tamaño de melocotón. En cada caso, tenían que indicar el nivel de atributo (y a la vez el atributo), más importante y el menos importante, que justificaría la compra del melocotón. Cuatro aproximaciones, resultantes de la combinación de los métodos de estimación por Mínimos Cuadrados Ponderados (MCP), multinomial logit (MNL) y los análisis Marginal y por Pares, han sido comparadas.

En trabajos anteriores se ha observado que hay una fuerte relación entre estas cuatro aproximaciones, pero en nuestro estudio, hemos constatado que la diferencia media de los valores de los parámetros del análisis Marginal, calculados a partir del método MCP, son un 1,1% superior a los parámetros del análisis de Pares obtenidos por el mismo método, es decir, los análisis Marginal y de Pares generan parámetros con valores muy similar cuando son calculados por el método de Mínimos Cuadrados Ponderados. No obstante, esta misma diferencia es de un 22,2% cuando es calculada por el MNL. Por eso, si se va a estimar las preferencias por MCP, la elección del tipo de análisis no es una decisión tan relevante si las preferencias van a ser estimadas por MNL.

Cómo resultado común de todas las aproximaciones, se ha observado que la importancia del tipo de envase, del tamaño del melocotón y del precio en la compra del melocotón tardío es la misma. El único atributo que es significativamente más importante que los demás es el origen. Aunque estadísticamente no haya una diferencia significativa, los resultados indican que el consumidor considera el tamaño del melocotón después del origen mientras que el precio es el atributo menos importante.

El precio es el cuarto atributo más importante del melocotón DOP Calanda y es más importante que el tamaño y el tipo de envase, pero es el atributo menos importante del melocotón tardío. Esta diferencia se justifica principalmente porque los consumidores consideran el melocotón DOP Calanda como un producto de precio alto en el mercado. Pero, la propia naturaleza de los experimentos puede haber interferido en los resultados, ya que en un experimento la importancia del precio está asociada a un nivel de precios mientras que el experimento de importancia de atributos no. En este último experimento, la importancia del precio del melocotón DOP Calanda puede depender también de la interpretación de cada consumidor.

Las utilidades estimadas por el experimento de Mejor-Peor de atributos y niveles (encuesta 2009), que los consumidores han tenido mayor utilidad con el lugar de producción que la marca DOP Calanda, mientras que en el experimento de Mejor-Peor de multiatributos (encuesta 2008), los consumidores han tenido una mayor utilidad con la marca que con el lugar de producción.

Esta diferencia puede ser atribuida a la crisis que viene afectando a la economía española. Con la crisis, las grandes cadenas de distribución han promocionado las marcas blancas y los formatos de ahorro. La promoción del formato de compra también puede haber afectado a las preferencias por el tipo de envase. En el 2008, cuando la crisis estaba en su comienzo, los consumidores preferian el melocotón en envases normales pero en el siguiente año las preferencias cambiaron al melocotón a granel. Sin embargo lo que se ha mantenido es el rechazo por el envase activo.

Algunas diferencias de percepción de calidad de los consumidores, entre 2008 y 2009, han sido notadas con respeto al tamaño del melocotón. En el año 2008 los consumidores tuvieron un nivel de utilidad superior con los melocotones de tamaño medio (250g) al de los melocotones del tamaño más grande (380g) y este orden cambió en el año 2009. Es probable que, sabiendo que la relación de pulpa/hueso aumenta con el aumento del tamaño del melocotón, los consumidores preferieren el melocotón más grande para ahorrar en la compra de la fruta y quizás compartir la pieza con otra persona.

La siguiente etapa de análisis de los datos del experimento de Mejor-Peor de atributos y de niveles de atributos ha sido detectar la heterogeneidad en las preferencias de los consumidores por el modelo logarítmico mixto. Los resultados indican que las preferencias hacia la importancia del precio y el origen del melocotón tardío son homogéneas entre los consumidores, mientras que las preferencias dadas a la importancia del tamaño del melocotón son heterogéneas. Las mayores heterogeneidades de preferencias han sido observadas hacia los melocotones producidos con DOP Calanda, los de tamaño más grande (380g), el envase activo, el precio alto (3,6€/kg) y los melocotones a granel.

Con la intención de explicar la diversidad en las preferencias, se han estimado modelos para medir el efecto de interacción entre las características socio-económicas y actitudes del consumidor hacia el melocotón DOP Calanda con las características del melocotón tardío que presentan heterogeneidad en las preferencias. La edad del consumidor (dividida en dos clases: mayores y menores de 50 años) y el grado de fidelidad (alto o no) no han explicado las diferencias de utilidad y tanpoco las distintas importancias del tamaño del melocotón.

En 2009, la valoración del papel del tamaño del melocotón en las compras puede ser explicada por la regularidad del consumo del melocotón DOP Calanda, el nivel de educación, género del consumidor y su nivel de ingresos familiares. Con relación al año anterior, hay un mayor número de caracterísctas del consumidor que interactua con esta característica del melocotón. Este cambio se debe por las diferentes situaciones económicas de los años 2008 y 2009.

En 2009, tanto los consumidores con altos ingresos familiares, superior a 1.500€/mes, como los consumidores con ingresos familiares más bajos han dado la misma importancia al tamaño del melocotón. Sin embargo, los consumidores de ingresos más bajos han tenido una menor utilidad con los melocotones de 380g. Como en un kilo de melocotones de 380g entran menos piezas de frutas que en un kilo de melocotones de 250g, las familias de menores ingresos preferian menos los melocotones de 380g para que el valor de la compra fuera menor. Atendiendo al ahorro también se puede explicar la mayor importancia dada al tamaño del melocotón y la menor utilidad que los consumidores con nivel de educación elemental tienen con los melocotones de 380g. En general, los consumidores con educación elemental tienen un nivel de ingreso familiar inferior que los consumidores con más estudios. Así que, en años de peor situación económica, el tamaño óptimo del melocotón aumenta pero hay una menor aceptación de los melocotones muy grandes.

Los hombres han considerado el tamaño del melocotón más importante que las mujeres, no obstante no se han detectado diferencias significativas entre estos dos tipos de consumidores en relación a la utilidad asociada a los tres niveles de tamaño del melocotón (160g, 250g y 380g). También en relación al género del consumidor, las mujeres tienen una mayor utilidad negativa con los melocotones de precio alto (3,6€/kg) y con los envases activos que los hombres.

8.2.2 Conclusiones

El presente estudio ha generado nuevas informaciones sobre las preferencias declaradas hacia el melocotón de los consumidores de Zaragoza. Estas nuevas informaciones pueden orientar al sector privado en su estrategia de mercado para la obtención de mayores beneficios; y al sector público las informaciones pueden ayudar en la elaboración de sus políticas de aumento del consumo de melocotón. Académicamente, el trabajo se ha basado en diferentes experimentos de elección para el estudio del comportamiento de los consumidores, mediante el uso de las mejores y peores alternativas. A continuación, se presentan las principales conclusiones del trabajo:

a) Los consumidores diferencian la calidad del melocotón por el atributo procedencia y prefieren el producto con garantía de calidad. La Denominación de Origen Protegida (DOP) Calanda, que reune la procedencia (Calanda) y control de calidad (DOP) es el nivel de atributo más valorado y la procedencia de Calanda, es el segundo nivel más valorado del atributo procedencia de los melocotones tardíos por parte de los consumidores de Zaragoza. El sabor es el parámetro de calidad más valorado y es el atributo más importante que justifica la compra del melocotón DOP Calanda, seguido por el grado de madurez. Por lo tanto, la marca genérica (DOP Calanda) cumple su función de informar y garantizar la calidad del melocotón.

b) Aunque para algunos consumidores la calidad organoléptica (sabor y olor) del melocotón DOP Calanda ha disminuido en las dos últimas décadas, el nivel de satisfacción con la calidad del melocotón DOP Calanda es alta. No obstante, los consumidores esporádicos creen que el sabor del melocotón DOP Calanda es mejorable.

c) Aunque el tamaño del melocotón DOP Calanda sea el octavo atributo más importante en su compra cuando no se especifica los niveles para los consumidores (ellos asumen ciertos niveles), sin embargo el tamaño del melocotón influye de manera significativa en las decisiones de compra de los consumidores cuando se les ofrece distintas opciones de tamaño. Los melocotones pequeños tienen poca aceptación en el mercado y, hasta un cierto límite, cuanto más grande es el melocotón mejor es su valoración. No todas las personas son capaces de comer una pieza de melocotón del tamaño más grande (380g) de una sola vez. El tamaño del melocotón tiene una atracción visual muy fuerte en las compras, pero también se entiende como un factor de ahorro en las compras. En periodos de aguda situación económica, los melocotones de mayor dimensión son preferidos porque se obtiene una mayor proporción de carne en la fruta en relación al tamaño del hueso.

d) La mayoría de los consumidores prefieren comer una pieza de melocotón por si solos. No obstante, si la pieza de fruta es demasiado grande, una cierta proporción de consumidores están dispuestos a compartir la pieza con otra persona y, un menor número, guardan la fruta para terminar de comerla en otro momento. Desde el punto de vista de la mayoría de los consumidores, el tamaño óptimo del melocotón tardío se sitúa alrededor de 310 gramos por pieza. Sin embargo, para algunos consumidores este tamaño óptimo puede variar. Los hombres y los consumidores menores de 50 años desean melocotones de tamaño más grande que las mujeres y los consumidores mayores de esta edad, respectivamente.

e) Los envases han contribuido a adecuar el producto a las necesidades y deseos del consumidor moderno. No obstante, los consumidores consideran el tipo de envase del melocotón DOP Calanda como el atributo menos importante que determina su compra. Con motivo del cambio de situación económica vivida entre 2008 y 2009, de una ligera inclinación (estadísticamente indiferente) hacia los melocotones envasados ha pasado hacia la preferencia por el formato tradicional (granel). Bajo el punto de vista de la calidad objetiva, la calidad del melocotón en envase activo es superior al envase normal, pero la percepción del consumidor es todo lo contrario, ya que valoran en gran medida el carácter perecedero del producto porque lo asocia al frescor. Para que este tipo de innovación tecnológica pueda tener éxito en el mercado, hay que hacer esfuerzos por informar al consumidor de que el producto no pierde su propiedad natural y su frescor, características que no están necesariamente relacionadas con la fecha de caducidad.

f) Los consumidores son sensibles al precio del melocotón e incluso algunos lo utilizan como parámetro de calidad. Hay un segmento de mercado que considera el precio del melocotón DOP Calanda como el atributo más importante en sus decisiones de compra, pero la mayoría de los segmentos no lo consideran como un atributo importante. Los consumidores habituales, los que tienen alto grado de fidelidad hacia el melocotón DOP Calanda, las mujeres, los de educación elemental, los de edad igual o superior a 50 años y los de ingresos familiares inferiores a 1.500€/mes son los consumidores menos sensibles al precio del melocotón tardío. Hay etnocentrismo por parte de un colectivo mayor, de bajos ingresos y formación, y que está familiarizado con el melocotón DOP Calanda.

g) Por la naturaleza de los experimentos de elección, los consumidores se han mostrado poco sensibles a los niveles precios y las estimaciones de las disposiciones a pagar han superado los precios practicados en el mercado. Por lo tanto, ha sido necesario corregir sus disposiciones a pagar. El experimento en el que los consumidores indican los mejores y los peores niveles de atributos y sus máximas disposiciones a pagar, ha sido una buena herramienta para ajustar las disposiciones a pagar calculadas por la anterior metodología. La máxima disposición a pagar por unos melocotones con la peor procedencia, sin DOP, tamaño y envase es de 1,05€/kg mientras que la máxima disposición a pagar por las mejores de estas características es de 2,21€/kg.

h) El valor de la marca genérica DOP Calanda es lo más valorado del melocotón tardío. En el año 2008, los consumidores de Zaragoza, estaban dispuestos a pagar 0,46€/kg por un melocotón DOP Calanda en vez de un melocotón que proviniera de Calanda pero sin la DOP, 0,35/€/kg por la producción en la zona de Calanda en comparación con lo producido fuera de Calanda, pagarían 0,10€/kg por obtener melocotones a granel en vez de melocotones condicionados en envases activos y 0,20€/kg por pasar de un melocotón de 160g a uno de 310g. El valor del rechazo de los consumidores por el envase activo es de 0,15€/kg en relación a un envase normal y por cambiar de un melocotón de 310g a uno de 380g están dispuestos a aceptar 0,04€/kg.

i) La indicación de la peor alternativa dentro del conjunto de alternativas disponibles representa una fuente de información adicional a la investigación. La introducción de este tipo de información en el análisis aumenta la precisión de los parámetros estimados y tiene un mayor impacto en la precisión de los parámetros de los atributos menos importantes.

j) La varianza de las respuestas de las peores opciones es mayor que la varianza de las contestaciones de las mejores opciones. Es decir, los consumidores son más unánimes en lo que les gusta, sin embargo divergen más en lo que no les gusta. Esta diferencia en la varianza depende del tipo de experimento de elección, ya que, en el experimento de elección de multiatributos la diferencia de variancia entre las mejores y las peores opciones es de un 46,1% mientras que en el experimento de elección de atributos la diferencia es de un 4,6%, es decir, la diferencia varia hasta 10 veces dependiendo del tipo de experimento de elección, con mayor variación en aquellos experimentos con información detallada.

k) La distribución normal de las preferencias es un supuesto básico de las estimaciones de las preferencias medias de los consumidores por modelos multinomiales (MNL). Por medio de la estimación de una función de utilidad de cada consumidor y a través del método Bottom-up se ha constatado que esta condición no se cumple. La distribución de las preferencias de los diferentes niveles de origen (de la zona de Calanda con DOP Calanda y de fuera de Calanda sin una DOP), que son los niveles de atributos que han proporcionado (dis)utilidades más extremas, son los parámetros más alejados de la distribución normal.

l) Los consumidores han podido ser clasificados según sus preferencias estimadas por funciones de utilidad individual. Han sido agrupados por el tipo de característica del melocotón tardío por los que se han distinguido (atributos y niveles de atributos), y cómo han valorado esta característica (utilidad positiva o negativa).

m) El modelo Bottom-up tiene una mejor adaptación que otros modelos contrastados para la estimación de funciones de utilidad individual. Es decir, él es el mejor modelo en una situación con pocas observaciones porque es capaz de generar un mayor número de parámetros estadísticamente significativos que los demás modelos. No obstante, este modelo (Bottom-up) genera los parámetro menos precisos y tiene el peor ajuste para las estimaciones de la muestra (todos los consumidores juntos).

n) La medición del impacto del atributo y de la utilidad marginal proporcionada por los niveles de atributos, en una escala común a través del experimento de Mejor-Peor de atributos y niveles, es un análisis relevante porque aunque los consumidores no hayan discriminado los niveles de un atributo, es posible que este atributo sea importante en la decisión del consumidor. Basándose en los resultados obtenidos del experimento, las aproximaciones, de análisis de Pares o Marginal, generan los mismos parámetros cuando son calculados por el método de los Mínimos Cuadrados Ponderados. Sin embargo, los parámetros de la aproximación Marginal tienen una mayor magnitud que los de Pares si son calculados por medio de modelos multinomiales. Por lo tanto, si la intención del investigador es hacer estimaciones a nivel de muestra, el método de estimación más indicado es por Mínimos Cuadrados Ponderados porque en estas condiciones ambas aproximaciones de análisis dan los mismos resultados.

8.2.3 Futuras lineas de investigación

Durante la realización del trabajo de investigación, dadas las restricciones de tiempo y recursos, se han tenido que elegir los aspectos más relevantes de las preferencias de los consumidores acerca del consumo del melocotón tardío, asi como los métodos experimentales y analíticos. Las informaciones generadas con la investigación han contribuindo a la mejor comprensión del comportamiento de los consumidores respeto al melocotón tardío, dando más énfasis para aquellos con DOP Calanda, en Zaragoza y del uso de los experimentos de elecciones discretas de la mejores y peores alternativas. No obstante todo el proceso se prodría mejorar en un futuro.

La primera sugerencia es la ampliación del estudio a otras localidades. Nuestros resultados se limitan a las preferencias de los consumidores de Zaragoza, que es una ciudad cercana a la zona de producción del melocotón DOP Calanda. Esta cercanía ha contribuido a una mayor valoración de la marca del melocotón DOP Calanda y de la zona de producción Calanda. A nivel nacional, Madrid y Barcelona son las dos localidades donde se podrían contrastar las preferencias. El estudio de las preferencias en el mercado consumidor de Madrid se justifica por su dimensión, mientras que el mercado consumidor de Barcelona es relevante, además de por su dimensión, por contar con una producción local importante. Asimismo, a nivel internacional, los mercados europeos son prioritarios por su proximidad. Los consumidores de los países tradicionalmente importadores de frutas, con un amplio mercado, como Alemania e Inglaterra, podrían proporcionar informaciones relevantes a los productores de melocotones en España.

El diseño experimental adoptado en el experimento de elección de multiatributos solamente permite la estimación de efectos principales que los niveles de atributos tienen en las decisiones de compra. Considerando que los consumidores han rechazado el envase activo, que es valorado como de calidad inferior, y que la marca DOP Calanda goza de mucho prestigio entre los consumidores, hubiera sido relevante medir el efecto, si lo hay, que la marca generica tiene para mitigar el rechazo a tal innovación. Para eso, los futuros trabajos deberían contar con un diseño experimental que permita medir las interacciones entre la marca DOP Calanda y el envase activo.

Los productores de melocotón dedican muchos recursos para aumentar el tamaño de las frutas. En este trabajo se ha estimado la variación de utilidad que los consumidores tienen con la variación del tamaño del melocotón, y se ha llegado a conclusiones sobre el tamaño más apreciado por los consumidores. La complementariedad de los resultados proporcionados con informaciones de costes marginales relacionados a los diferentes calibres de melocotón, podría llevar a unas recomendaciones objetivas del mejor calibre de melocotón para el sector y, como consecuencia, podrían aumentar su competitividad.

El tipo de preferencias abordadas en este trabajo son las declaradas. En comparación con las preferencias reales, las preferencias declaradas gozan de determinadas ventajas, como brindar la posibilidad de evaluar la innovación del envase activo. Sin embargo, los valores estimados de las disposiciones al pago son superiores al practicado en el mercado. Por la falta de datos de preferencias reales, se tuvo que aplicar un nuevo cuestionario para realizar las ponderaciones de las disposiciones a pagar. Es de interés comparar la eficacia del método utilizado de ponderación con datos de preferencia reales. Caso que no fuera posible disponer de datos en puntos de venta (los datos scanner son comúnmente usados), se podrían incorporar preguntas sobre la última compra de melocotón tardío realizada por el consumidor en futuros cuestionarios, ya que esta información estaría más cercana a la preferencias reales del consumidor.

En el caso de la estimación de la importancia de los atributos, el experimento de elección Mejor-Peor sirve especialmente para mejorar la precisión de los parámetros de los atributos menos importantes, pero el impacto en la precisión de los parámetros estimados de los atributos de importancia intermedia es pequeño. Si se considera que tanto los atributos más importantes, como los de menor importancia, son más fácilmente identificados por el sector melocotonero, los atributos de importancia intermedia pueden ser utiles en la diferenciación de los productos. En este caso, es deseable que métodos de investigación de mercado que hagan una mayor referencia a los atributos de importancia intermedias, aunque los más importantes sean cruciales para la comunicación.

La importancia de los atributos del melocotón DOP Calanda ha sido evaluada de forma verbal, es decir, se mencionaba el nombre del atributo sin dar ninguna información adicional sobre los niveles del atributo al consumidor. Por ejemplo, se ha preguntado sobre la importancia relative del tipo de envase y tamaño del melocotón en la compra del consumidor. En esta comparación cada consumidor puede tener una interpretación propia sobre estos parámetros, por lo que una mejora de la información de los atributos podría suponer una mayor precisión en los resultados.

El experimento de elección de Mejor-Peor de atributos mide la importancia relativa de los atributos y no la importancia absoluta. Los 10 atributos del melocotón DOP Calanda seleccionados para la investigación han sido elegidos por su importancia estratégica y a través de una valoración cualitativa. Hubiera sido interesante incorporar en el cuestionario del 2008 alguna valoración de importancia absoluta del atributo, por ejemplo, a través de una escala de Likert se tendría una referencia más cercana de la importancia absoluta del atributo.

Los resultados de las mediciones de las importancias de los atributos y de las utilidades de sus niveles en una misma escala han sido satisfactorios porque ha generado información relevante para la investigación. Sin embargo, hubiera sido posible explotar más los datos disponibles con la incorporación de una pregunta adicional en cada conjunto de elección. Esta pregunta estaría relacionada con la compra del melocotón y esta información adicional también actuaría como una referencia a los resultados obtenidos.

Las funciones de utilidad individuales han superado algunas debilidades de las estimaciones de preferencia a nivel global de la muestra. La forma de analizar los resultados de estas estimaciones ha proporcionado resultados coherentes con las demás análisis llevados a cabo en este estudio. No obstante, hay algunos aspectos que podrían ser mejorables. Por ejemplo, es necesario investigar empíricamente y por medio de simulaciones, el efecto del número de alternativas en cada conjunto de elección y el número de conjuntos de elección que cada consumidor tendría que contestar para que pudiera haber menos consumidores indiferentes en relación a los niveles de atributos presentados y que cada consumidor pudiera distinguir más niveles de atributos.

Hasta la actualidad, el modelo Bottom-up ha sido empleado para la estimación de funciones de utilidad individuales en experimentos de elección de multiatributos. En futuras investigaciones el modelo Bottom-up podría ser empleado, por ejemplo, en estimación de funciones individuales de importancia relativa de los atributos. El cálculo de la importancia relativa de los atributos a nivel individual ha sido calculado por el resultado de la diferencia entre número de veces que el atributo ha sido elegido como el más importante y el número de veces que ha sido elegido como el menos importante (Best-Worst Score - BWS). Calculando el BWS de cada atributo no se consideran los escenarios en el que el atributo ha sido elegido (qué atributos competían la elección del consumidor), mientras que en las estimaciones individuales esta situación sería considerada.

El estudio de las preferencias de cada consumidor, por las funciones de utilidad individualizadas, parece ser un área de investigación muy prometedora. Este método de análisis todavía demanda mucho tiempo del analista porque los programas de estimación no están adaptados a este tipo de estudio. Este problema se solucioná una vez conocidas y popularizando las ventajas del modelo Bottom-up en los estudios de preferencias

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Appendix 1: Survey of 2008, in English

Date: ………….. Time: …………..

Hypermarket: Augusta ☐ Actur ☐

Survey to consumers of peaches with PDO Calanda[13]
Part I

1. ¿Have you bought **PDO Calanda peaches** in the last two years?

☐ **Yes** ☐ **No** DISCART IF NEGATIVE ANSWER

2. How often do you consume, at home, **PDO Calanda peaches**?

☐ More than 2 times per week ☐ Once a month
☐ From 1 to 2 times a week ☐ Once all season
☐ Once each 2 weeks

3. When the piece of **PDO Calanda peach** is too large, how would you consume it?

	Never	Some times	Always
a) I share with other person	[ ]	[ ]	[ ]
b) I eat it at once	[ ]	[ ]	[ ]
c) I eat it lat several periods of time	[ ]	[ ]	[ ]
d) Other: …………………………………………………..	[ ]	[ ]	[ ]

4. Where do you stock **PDO Calanda peaches?**

☐ In the refrigerator ☐ In the fruit bowl ☐ In other place:…………………………………………………

5. How many days do you usually take to consume **PDO Calanda peaches** after purchasing them?

…………………..(state the number of days)

6. Where do you buy regularly **DO Calanda peaches**? (Only establishments where you buy, by importance order,where 1 the most common and the least common 5)

In the markets	[ ]	Hypermarkets	[ ]
In traditional stores	[ ]	Other…………………………………………………….	[ ]
Supermarkets	[ ]		

7. In your opinion, what is the fruit that competes more directly with **PDO Calanda peaches?**
……………………………………………………………………………(state the fruit name)

8. Could you evaluate, according to your degree of agreement or disagreement, the following opinions by scoring 1 (strongly disagree) to 5 (strongly agree).

	1	2	3	4	5
a) Peach is a fruit that I have the habit of consuming it since my childhood.	[ ]	[ ]	[ ]	[ ]	[ ]
b) I have qualms about buying fruit that have been touched by others on the shelves.	[ ]	[ ]	[ ]	[ ]	[ ]
c) If all consumers wear gloves, I still feel hesitate to buy touched peaches.	[ ]	[ ]	[ ]	[ ]	[ ]
d) If I buy **PDO Calanda peaches** I avoid sells of peaches from other places and I get benefits with the promotion of Aragon economy.	[ ]	[ ]	[ ]	[ ]	[ ]
e) When I buy **PDO Calanda peaches** I know that the environmental quality in the production area will improve because they use cleaner production techniques.	[ ]	[ ]	[ ]	[ ]	[ ]
f) Eating **PDO Calanda peaches** is healthier than other peaches because they use less fertilizers and pesticides.	[ ]	[ ]	[ ]	[ ]	[ ]
g) **PDO Calanda Peaches** are more nutritive than other peaches	[ ]	[ ]	[ ]	[ ]	[ ]
h) At purchasing, I know how to identify perfectly those peaches that have the best quality and taste.	[ ]	[ ]	[ ]	[ ]	[ ]
i) If they had the same quality, I would like to buy **PDO Calanda peaches** starting in August.	[ ]	[ ]	[ ]	[ ]	[ ]
j) If they had the same quality, I would like to buy **PDO Calanda peaches** during November and December.	[ ]	[ ]	[ ]	[ ]	[ ]

[1] I am doing this work for the Centre of Agrofood Research and Technology of Aragon which depends of the Government of Aragon. In strict compliance to the Organic Law 15/1999 of December 13th, of Personal Data Protection, your data and feedback are strictly anonymous. They will only be employed to study scientifically consumer behaviour of Protected Designation of Origin (PDO) Calanda peaches, and they will not be spread individually. In order to assess properly your preferences, we ask you to answer all questions.

Part II - A

Description of how to answer the next questions:

We will present 8 cards; each one has 5 characteristics of **PDO Calanda peach** that influence your purchase.

Characteristic

1) Taste	2) Colour	3) Price	4) Produced in bags	5) Smell
6) Size	7) Type of packing	8) Ripeness	9) Skin fuzziness	10) Texture

The answer is simple, first you have to evaluate the features presented on the card, so that, according to your preference, indicate, with a cross, the most important feature that you consider when buying PDO Calanda peaches and then, with another cross, the least important feature.

Card 1		
Least important	**Characteristic**	**Most important**
☐	Colour	☐
☐	Size	☐
☐	Skin fuzziness	☐
☐	Produced in bags	☐
☐	Taste	☐

Card 2		
Least important	**Characteristic**	**Most important**
☐	Size	☐
☐	Price	☐
☐	Texture	☐
☐	Smell	☐
☐	Ripeness	☐

Card 3		
Least important	**Characteristic**	**Most important**
☐	Ripeness	☐
☐	Produced in bags	☐
☐	Taste	☐
☐	Texture	☐
☐	Type of packaging	☐

Card 4		
Least important	**Characteristic**	**Most important**
☐	Smell	☐
☐	Skin fuzziness	☐
☐	Price	☐
☐	Ripeness	☐
☐	Produced in bags	☐

Card 5		
Least important	**Characteristic**	**Most important**
☐	Skin fuzziness	☐
☐	Ripeness	☐
☐	Colour	☐
☐	Size	☐
☐	Texture	☐

Card 6		
Least important	**Characteristic**	**Most important**
☐	Taste	☐
☐	Type of packing	☐
☐	Size	☐
☐	Price	☐
☐	Colour	☐

Card 7		
Least important	**Characteristic**	**Most important**
☐	Type of packing	☐
☐	Texture	☐
☐	Smell	☐
☐	Colour	☐
☐	Skin fuzziness	☐

Card 8		
Least important	**Characteristic**	**Most important**
☐	Price	☐
☐	Taste	☐
☐	Produced in bag	☐
☐	Type of packing	☐
☐	Smell	☐

Part II - B

Purchasing description:

In this part of the questionnaire there will be 9 purchase situations of peaches. Each one includes 3 alternatives or purchasing options. They are described by different prices, type of packaging, sizes and fruits origins. These features can take the values listed in Table 1.

Table 1. Relation between the options characteristics and values of purchasing peaches.

Characteristic	Values		
Price	1.50 €/kg	2.50 €/kg	3.50 €/kg
Origin	**From** Calanda area, **with** PDO	**From** Calanda area, **without** PDO	**From** other area, **without** PDO
Type of packing	Buck	Normal packing	Active packing
Fruit size	Small	Medium	Big

Those peaches that are packed in active packing do not have negative health effects and can be maintained, with the same quality, up to 12 days longer than those provided in normal packaging. For you to recognize different types of packing and fruit sizes, please, first look at the samples that are available with the interviewer.

Please, make sure you have answered all the alternatives. There is no right or wrong answers, it is just choosing the options according to your preferences. On the next page, there is an example illustrating of how to answer each buying situation.

Least preferable	Situation 1	Most preferable
	Alternative A	
	1.50 €/kg	
☐	**From** other area **without** PDO	☐
	Bulk	
	Small	
	Alternative B	
	2.50 €/kg	
☐	**From** Calanda area **without** PDO	☐
	Normal packing	
	Medium	
	Alternative C	
	3.50 €/kg	
☐	**From** Calanda area **with** PDO	☐
	Active packing	
	Big	
If I could, I would not choose any of the previous ☐		

Least preferable	Situation 2	Most preferable
	Alternative A	
	2.50 €/kg	
☐	**From** Calanda area **without** PDO	☐
	Normal packing	
	Small	
	Alternative B	
	3.50 €/kg	
☐	**From** Calanda area **with** PDO	☐
	Active packing	
	Medium	
	Alternative C	
	1.50 €/kg	
☐	**From** other area **without** PDO	☐
	Bulk	
	Big	
If I could, I would not choose any of the previous ☐		

Least preferable	Situation 3	Most preferable
	Alternative A	
	3.50 €/kg	
☐	**From** Calanda area **without** PDO	☐
	Bulk	
	Big	
	Alternative B	
	1.50 €/kg	
☐	**From** Calanda area **with** PDO	☐
	Normal packing	
	Small	
	Alternativa C	
	2.50 €/kg	
☐	**From** other area **without** PDO	☐
	Active packing	
	Medium	
If I could, I would not choose any of the previous ☐		

Least preferable	Situation 4	Most preferable
	Alternative A	
	2.50 €/kg	
☐	**From** Calanda area **with** PDO	☐
	Bulk	
	Medium	
	Alternative B	
	3.50 €/kg	
☐	**From** other area **without** PDO	☐
	Normal packing	
	Big	
	Alternative C	
	1.50 €/kg	
☐	**From** Calanda area **without** PDO	☐
	Active packing	
	Small	
If I could, I would not choose any of the previous ☐		

Least preferable	Situation 5	Most preferable
	Alternative A	
	3.50 €/kg	
☐	**From** Calanda area **with** PDO	☐
	Active packing	
	Small	
	Alternative B	
	1.50 €/kg	
☐	**From** other area **without** PDO	☐
	Bulk	
	Medium	
	Alternative C	
	2.50 €/kg	
☐	**From** Calanda area **without** PDO	☐
	Normal packing	
	Big	
If I could, I would not choose any of the previous ☐		

Least preferable	Situation 6	Most preferable
	Alternative A	
	1.50 €/kg	
☐	**From** Calanda area **without** PDO	☐
	Active packing	
	Medium	
	Alternative B	
	2.50 €/kg	
☐	**From** Calanda area **with** PDO	☐
	Bulk	
	Big	
	Alternative C	
	3.50 €/kg	
☐	**From** other area **without** PDO	☐
	Normal packing	
	Small	
If I could, I would not choose any of the previous ☐		

Least preferable	Situation 7	Most preferable
☐	**Alternative A** 1.50 €/kg **From** Calanda area **with** PDO Normal packing Big	☐
☐	**Alternative B** 2.50 €/kg **From** other area **without** PDO Active packing Small	☐
☐	**Alternative C** 3.50 €/kg **From** Calanda area **without** PDO Bulk Medium	☐
If I could, I would not choose any of the previous ☐		

Least preferable	Situation 8	Most preferable
☐	**Alternative A** 3.50 €/kg **From** other area **without** PDO Normal packing Medium	☐
☐	**Alternative B** 1.50 €/kg **From** Calanda area **without** PDO Active packing Big	☐
☐	**Alternative C** 2.50 €/kg **From** Calanda area **with** PDO Bulk Small	☐
If I could, I would not choose any of the previous ☐		

Least preferable	Situation 9	Most preferable
☐	**Alternative A** 2.50 €/kg **From** other area **without** PDO Active packing Big	☐
☐	**Alternative B** 3.50 €/kg **From** Calanda area **without** PDO Bulk Small	☐
☐	**Alternative C** 1.50 €/kg **From** Calanda area **with** PDO Normal packing Medium	☐
If I could, I would not choose any of the previous ☐		

Socio-demographic characteristic: Part III

9. Gender:

☐ Man ☐ Woman

10. Could you indicate your year of birth? 19............

11. Could you indicate your education level?

☐ Elementary ☐ College

☐ High school

12. How many people, including you, live at home and eat PDO Calanda peaches?
(Indicate the number of people according to the age class)

Younger than 5 years......................... From 6 to 10 years..........................
From 11 to 20 years.............................. From 21 to 40 years..........................
From 41 to 65 years............................. Older than 65 years..........................

13. Could you state, approximately, your household income level per month?

☐ Less than 900€ (less than 150,000 pts) ☐ From 2,101 to 3,000 € (from 350,001 to 500,000 pts)

☐ From 901 a 1,500 € (from 150,001 to 250,000 pts) ☐ From 3,001 to 4,000 € (from 500,000 to 666,000 pts)

☐ From 1,501 to 2,100 € (from 250,001 to 350,000 pts) ☐ Higher than 4,000 € (Higher than 666,000 pts)

14. Could you indicate the working activity of the person who goes shopping?

☐ Works full time at home

Works outside home

☐ partially

☐ full time

15. The house where you live has an area of ....m^2 and ....(number) bathrooms.

Thanks for your collaboration!
Here is a sample of PDO Calanda peaches!
Please, we should do only one survey by household

Appendix 2: Survey of 2009, in English

Date:
Time:
Hypermarket:
Augusta
Actur

Consumers survey to consumers of peaches with Protected Designation of Origin Calanda[14]

Part I

1. Have you bought **PDO Calanda peaches** in the last two years?

Yes No

2. How often do your consume, at home, **PDO Calanda peaches**? (Mark an **X** in the option)

- More than once a week
- Once each 2 weeks
- Once a month
- Once during all season

3. Where do you regularly buy **PDO Calanda peaches?**
(By importance order, where 1 the most regular and 3 the least regular)

- In the markets
- Supermarkets
- Growers

4. In your opinion, which fruit would you buy if there were not **PDO Calanda peaches** in the market? (Mark an **X** in the option)

- Other peach
- Nectarine
- Orange, mandarin
- Apple, pear
- Melon

5. Could you evaluate, according to your agreement and disagreement, the following statements by scoring 1 (strongly disagree) to 5 (strongly agree). (You have to mark an **X** in the option)

	1	2	3	4	5
a) I like peaches of very big size					
b) Big size peaches taste better					
c) Small size peaches can be stoked less time					
d) PDO Calanda Peaches have an excellent taste					
e) PDO Calanda Peaches smell very well					
f) PDO Calanda Peaches have optimal ripeness					
g) I pay more for a PDO brand because I know it is authentic					
h) I prefer a not too ripened peach					
i) At home, peaches damage quickly					
j) Packaged peaches taste and smell the same					
k) I do not trust peaches packaged during long time					
l) Packaged fresh fruit damages heath					
m) I have no time, so I prefer packaged fruit					

[1]I am doing this work for the Centre of Agrofood Research and Technology of Aragon which depends of the Government of Aragon. In strict compliance to the Organic Law 15/1999 of December 13th, of Personal Data Protection, your data and feedback are strictly anonymous. They will only be employed to study scientifically of consumer behaviour of Protected Designation of Origin (PDO) Calanda peaches, and they will not be spread individually. In order to assess properly your preferences, we ask you to answer all questions.

Peaches characteristics evaluation- Part II A

In this survey we are evaluating certain characteristics of late season peaches. The features are: the origin, type of packaging and peach size. And they may vary as shown in Table 1.

Table 1. Late season peaches characteristics for first evaluation

Origin	Type of packaging	Peach size
From Calanda area **with** PDO Calanda	Bulk	Small
From Calanda area **without** PDO Calanda	Normal parking	Medium
Other area **without** PDO	Active packing	Big

The origin tells where the peach was produced (in Calanda area or not) and if it has the Protected Designation of Origin (PDO) Calanda guarantee or not. With regards to active packing, peaches do not have adverse health effects and can be maintained, with the same quality, up to 12 days longer than those provided in normal packaging. The peaches weight varies from 160 g (small) to 400 g (large) and the middle size is 250 g. For you to recognize the different types of packaging and fruit sizes, please, first have a look at the samples which are available with the interviewer.

6. Could you state the best and the worst characteristic of late season peaches?
(Mark an **X** in the option)

The origin

	Worst option	Best option
From Calanda area **with** PDO Calanda		
From Calanda area **without** PDO Calanda		
Other area **without** PDO		

The type of packaging

	Worst option	Best option
Bulk		
Normal parking		
Active packing		

The peach size

	Worst option	Best option
Small		
Medium		
Big		

7. Regarding the price, what is the maximum price that you would be willing to pay for highest quality for late season peach (that one with the best origin, size and packaging) and lowest quality (that one with the worst origin, size and packing)?

The peach with highest quality	€/kg.
The peach with lowest quality	€/kg.

8. What peach would you buy?
(Mark an **X** on chosen option)

The peach with highest quality	
The peach with lowest quality	

9. You indicated that the price difference between the highest and lowest quality peach is (   ) €/kg, in order to explain this difference, what weight do you give for each characteristics listed below?

Peaches' characteristics:

The peach size	%
The origin	%
The type of packaging	%
Total	100%

Peaches characteristics evaluation- Part II B

Task description

In this part of the questionnaire you will have 9 product assessment situations. Each includes 4 alternatives and each alternative corresponds to a peach characteristic in a certain level. In table 2 are listed the values of price, packaging, size and origins levels taken are listed.

Table 1. Late season peaches characteristics for second evaluation

Characteristic	Values		
Price	Low Price (1.20 €/kg)	Medium Price (2.40 €/kg)	High Price (3.60 €/kg)
Origin	**From** Calanda area, **with** PDO Calanda	**From** Calanda area, **without** PDO Calanda	**From** other area, **without** PDO
Type of packaging	Bulk	Normal packing	Active packing
Fruit size	Small	Medium	Big

Please, make sure you have answered all the alternatives. There is no right or wrong answer; you have only to choose the options according to your preferences. To state the preferences, put an **"X"** in the most important option and one in the least important option that explain your peach purchasing.

Least important	Peach 1	Most important
	Low Price (1.2 €/kg)	
	From Calanda area, **with** PDO	
	Bulk peach	
	Small size	

Least important	Peach 2	Most important
	Low Price (1.2 €/kg)	
	From Calanda area, **without** PDO	
	Normal packing	
	Big size	

Least important	Peach 3	Most important
	Low Price (1.2 €/kg)	
	From other area, **without** PDO	
	Active packing	
	Medium size	

Least important	Peach 4	Most important
	Medium Price (2.4 €/kg)	
	From Calanda area, **with** PDO	
	Normal packing	
	Medium size	

Least important	Peach 5	Most important
	Medium Price (2.4 €/kg)	
	From Calanda area, **without** PDO	
	Active packing	
	Small size	

Least important	Peach 6	Most important
	Medium Price (2.4 €/kg)	
	From other area, **without** PDO	
	Bulk peach	
	Big size	

Least important	Peach 7	Most important
	High Price (3.6 €/kg)	
	From Calanda area, **with** PDO	
	Active packing	
	Big size	

Least important	Peach 8	Most important
	High Price (3.6 €/kg)	
	From Calanda area, **without** PDO	
	Bulk peach	
	Medium size	


Least important	Peach 9	Most important
	High Price (3.6 €/kg)	
	From other are, **without** PDO	
	Normal packing	
	Small size	

Socio-demographic: Part III

9. Gender
(Mark an **X** in the appropriate option)

Man ☐ Woman ☐

10. Could you indicate your year of birth 19 ☐

11. Could you indicate your education level?
(Mark an **X** in the appropriate option)

Elementary ☐
High school ☐
College ☐

12. How many people, including you, live at home and eat PDO Calanda peaches?
(Indicate the number of people according to the age class)

Younger than 5 years ☐
from 6 to 10 years ☐
from 11 to 20 years ☐
From 21 to 40 years ☐
From 41 to 65 years ☐
Older than 65 years ☐

13. Could you state, approximately, your household income level per month?
(Mark an **X** in the appropriate option)

Less than 900 € (less than 150,000 pts) ☐
From 901 to 1,500 € (from 150,001 to 250,000 pts) ☐
From 1,501 to 2,100 € (from 250,001 to 350,000 pts) ☐
From 2,101 to 3,000 € (from 350,001 to 500,000 pts) ☐
From 3,001 to 4,000 € (from 500,001 to 666,000 pts) ☐
Higher than 4,000 € (higher than 666,001 pts) ☐

14. Could you indicate the working activity of the person who goes shopping?
(Mark an **X** in the appropriate option)

She/he works full time at home ☐
She/he works outside home
Full time ☐
Partially ☐

Thanks for your collaboration!
Here is a sample of PDO Calanda peaches!
Please, we should do only one survey by household

Appendix 3: Survey of 2008, in Spanish

GOBIERNO DE ARAGON
Departamento de Ciencia, Tecnología y Universidad ....

cita CENTRO DE INVESTIGACIÓN Y TECNOLOGÍA AGROALIMENTARIA DE ARAGÓN

Hipermercado: Augusta ☐ Actur ☐

Encuesta a consumidores de melocotones con Denominación de Origen Calanda[15]
Parte I

1. ¿Ha comprado **melocotones de la DO Calanda** en los dos últimos años?

☐ **Sí** ☐ **No** SI ES NEGATIVO DESECHAR LA ENTREVISTA

2. ¿Con qué frecuencia se consume en su casa **melocotones con DO Calanda**?

☐ Más de 2 veces por semana ☐ 1 vez al mes
☐ De 1 a 2 veces a la semana ☐ 1 vez en toda la temporada
☐ 1 vez cada 2 semanas

3. Cuando la pieza del **melocotón de la DO Calanda** es demasiado grande, ¿Cómo la consume?

	Nunca	A veces	Siempre
a) Comparto con una persona	[ ]	[ ]	[ ]
b) La termino de comer yo mismo al momento	[ ]	[ ]	[ ]
c) La termino de comer en otro momento	[ ]	[ ]	[ ]
d) Otras: …………………………………………………..	[ ]	[ ]	[ ]

4. ¿Dónde conserva los **melocotones con DO Calanda?**

☐ En el frigorífico ☐ En un frutero ☐ En otro lugar:…………………………………………………………………

5. ¿Cuántos días tarda normalmente en consumir los **melocotones con DO Calanda** después de su compra?

…………………..(indicar el número de días)

6. ¿Dónde compra habitualmente los **melocotones con DO Calanda?** (solo los establecimientos donde compra, por orden de importancia, siendo 1 lo más habitual y 5 lo menos habitual)

En los mercadillos	[ ]	Hipermercados	[ ]
Tiendas tradicionales	[ ]	Otro…………………………………………………….	[ ]
Supermercados	[ ]		

7. En su criterio, ¿cuál es la fruta que compite más directamente con el **melocotón con DO Calanda?**

……………………………………………………………………………..(indicar el nombre de la fruta)

8. Podría valorar según su grado de acuerdo o desacuerdo las siguientes opiniones mediante una puntuación de 1 (muy en desacuerdo) a 5 (muy de acuerdo).

	1	2	3	4	5
a) El melocotón es una fruta que tengo la costumbre de consumirla desde mi infancia.	[ ]	[ ]	[ ]	[ ]	[ ]
b) Tengo reparos para comprar frutas que han sido tocadas por otras personas en las estanterías.	[ ]	[ ]	[ ]	[ ]	[ ]
c) Si todos usasen guantes en la compra de las frutas, aún sentiría reparos en comprarlas.	[ ]	[ ]	[ ]	[ ]	[ ]
d) Si compro **melocotones con la DO Calanda** evito la entrada de melocotones de otros lugares y me beneficio con el fomento la economía Aragonesa.	[ ]	[ ]	[ ]	[ ]	[ ]
e) Cuando compro **melocotones con la DO Calanda** sé que la calidad del medio ambiente en la zona de producción mejorará ya que usan técnicas de producción menos contaminantes.	[ ]	[ ]	[ ]	[ ]	[ ]
f) Comer **melocotones con la DO Calanda** es más sano que otros melocotones porque usan menos fertilizantes y defensivos.	[ ]	[ ]	[ ]	[ ]	[ ]
g) El **melocotón con DO Calanda** es más nutritivo que otros melocotones.	[ ]	[ ]	[ ]	[ ]	[ ]
h) En la compra, sé identificar perfectamente los melocotones que tienen la mejor calidad y sabor.	[ ]	[ ]	[ ]	[ ]	[ ]
i) Si tuviera la misma calidad, me gustaría poder comprar el **melocotón con DO Calanda** desde agosto.	[ ]	[ ]	[ ]	[ ]	[ ]
j) Si tuviera la misma calidad, me gustaría poder comprar el **melocotón con DO Calanda** durante los meses de noviembre y diciembre.	[ ]	[ ]	[ ]	[ ]	[ ]

[1] Estoy realizando este trabajo para el Centro de Investigación y Tecnología Agroalimentaria de Aragón dependiente del Gobierno de Aragón. En estricto cumplimiento con la Ley Orgánica 15/1999 de 13 de Diciembre de Protección de Datos de Carácter Personal, los datos y opiniones que nos proporcione son estrictamente anónimos. Únicamente se destinarán para el estudio científico del comportamiento del conjunto de consumidores de melocotones con Denominación de Origen (DO) Calanda, y no serán en ningún caso divulgados individualmente. Para poder evaluar correctamente sus preferencias le pedimos que responda a todas las preguntas.

Parte II - A

Descripción de cómo contestar a las próximas preguntas:

Le vamos a presentar 8 tarjetas, cada una presenta 5 características del **melocotón con Denominación de Origen de Calanda** que influyen en su compra.

Característica

1) Sabor	2) Color	3) Precio	4) Producido en bolsas	5) Olor
6) Tamaño	7) Tipo de envase	8) Estado de maduración	9) Pelusilla	10) Textura

La contestación es sencilla, primero usted tiene que evaluar las características presentes en la tarjeta, de tal manera que, de acuerdo con su preferencia, señale, con una cruz, la característica más importante que usted considera a la hora de comprar melocotones con la **Denominación de Origen de Calanda** y luego, con otra cruz, la característica menos importante.

Tarjeta 1

Menos importante	Característica	Más importante
☐	Color	☐
☐	Tamaño	☐
☐	Pelusilla	☐
☐	Producido en bolsas	☐
☐	Sabor	☐

Tarjeta 2

Menos importante	Característica	Más importante
☐	Tamaño	☐
☐	Precio	☐
☐	Textura	☐
☐	Olor	☐
☐	Estado de maduración	☐

Tarjeta 3

Menos importante	Característica	Más importante
☐	Estado de maduración	☐
☐	Producido en bolsas	☐
☐	Sabor	☐
☐	Textura	☐
☐	Tipo de envase	☐

Tarjeta 4

Menos importante	Característica	Más importante
☐	Olor	☐
☐	Pelusilla	☐
☐	Precio	☐
☐	Estado de maduración	☐
☐	Producido en bolsas	☐

Tarjeta 5

Menos importante	Característica	Más importante
☐	Pelusilla	☐
☐	Estado de maduración	☐
☐	Color	☐
☐	Tamaño	☐
☐	Textura	☐

Tarjeta 6

Menos importante	Característica	Más importante
☐	Sabor	☐
☐	Tipo de envase	☐
☐	Tamaño	☐
☐	Precio	☐
☐	Color	☐

Tarjeta 7

Menos importante	Característica	Más importante
☐	Tipo de envase	☐
☐	Textura	☐
☐	Olor	☐
☐	Color	☐
☐	Pelusilla	☐

Tarjeta 8

Menos importante	Característica	Más importante
☐	Precio	☐
☐	Sabor	☐
☐	Producido en bolsas	☐
☐	Tipo de envase	☐
☐	Olor	☐

Parte II - B

Descripción de la compra:

En esta parte del cuestionario se le van a presentar 9 situaciones de compra de melocotones. Cada una incluye 3 alternativas u opciones de compra. Son descritas por diferentes precios, condiciones de envasado, tamaños y orígenes de las frutas. Estas características pueden tomar los valores relacionados en la tabla 1.

Tabla 1. Relación entre las características y valores de las opciones de compra de melocotones.

Característica	Valores		
Precio	1,50 €/kg	2,50 €/kg	3,50 €/kg
Origen	**De** Calanda, **con** la Denominación de Origen (DO)	**De** Calanda, **sin** la Denominación de Origen (DO)	**Fuera de** Calanda, y **sin** la Denominación de Origen (DO)
Tipo de envase	A granel	Envase convencional	Envase activo
Tamaño	Pequeño	Medio	Grande

Los melocotones que están envasados en envases activos no presentarían efectos negativos para la salud y podrían mantenerse, con la misma calidad, hasta 12 días más que los dispuestos en envases convencionales. Para que usted reconozca los diferentes tipos de envase y tamaños de fruta, por favor, primero observe las muestras que están disponibles junto al encuestador.

Por favor, asegúrese que usted haya contestado a todas las alternativas. No hay respuestas correctas o incorrectas, se trata solo de elegir las opciones según sus preferencias. En la página siguiente hay un ejemplo ilustrativo de cómo contestar cada situación de compra.

Menos preferida	Situación 1	Más preferida
□	**Alternativa A**	□
	1,50 €/kg	
	Fuera de Calanda **sin** DO	
	Granel	
	Pequeño	
□	**Alternativa B**	□
	2,50 €/kg	
	De Calanda **sin** DO	
	Envase normal	
	Medio	
□	**Alternativa C**	□
	3,50 €/kg	
	De Calanda **con** DO	
	Envase activo	
	Grande	
Si pudiera, no elegiría ninguna de las opciones anteriores □		

Menos preferida	Situación 2	Más preferida
□	**Alternativa A**	□
	2,50 €/kg	
	De Calanda **sin** DO	
	Envase normal	
	Pequeño	
□	**Alternativa B**	□
	3,50 €/kg	
	De Calanda **con** DO	
	Envase activo	
	Medio	
□	**Alternativa C**	□
	1,50 €/kg	
	Fuera de Calanda **sin** DO	
	Granel	
	Grande	
Si pudiera, no elegiría ninguna de las opciones anteriores □		

Menos preferida	Situación 3	Más preferida
□	**Alternativa A**	□
	3,50 €/kg	
	De Calanda **sin** DO	
	Granel	
	Grande	
□	**Alternativa B**	□
	1,50 €/kg	
	De Calanda **con** DO	
	Envase normal	
	Pequeño	
□	**Alternativa C**	□
	2,50 €/kg	
	Fuera de Calanda **sin** DO	
	Envase activo	
	Medio	
Si pudiera, no elegiría ninguna de las opciones anteriores □		

Menos preferida	Situación 4	Más preferida
□	**Alternativa A**	□
	2,50 €/kg	
	De Calanda **con** DO	
	Granel	
	Medio	
□	**Alternativa B**	□
	3,50 €/kg	
	Fuera de Calanda **sin** DO	
	Envase normal	
	Grande	
□	**Alternativa C**	□
	1,50 €/kg	
	De Calanda **sin** DO	
	Envase activo	
	Pequeño	
Si pudiera, no elegiría ninguna de las opciones anteriores □		

Menos preferida	Situación 5	Más preferida
□	**Alternativa A**	□
	3,50 €/kg	
	De Calanda **con** DO	
	Envase activo	
	Pequeño	
□	**Alternativa B**	□
	1,50 €/kg	
	Fuera de Calanda **sin** DO	
	Granel	
	Medio	
□	**Alternativa C**	□
	2,50 €/kg	
	De Calanda **sin** DO	
	Envase normal	
	Grande	
Si pudiera, no elegiría ninguna de las opciones anteriores □		

Menos preferida	Situación 6	Más preferida
□	**Alternativa A**	□
	1,50 €/kg	
	De Calanda **sin** DO	
	Envase activo	
	Medio	
□	**Alternativa B**	□
	2,50 €/kg	
	De Calanda **con** DO	
	Granel	
	Grande	
□	**Alternativa C**	□
	3,50 €/kg	
	Fuera de Calanda **sin** DO	
	Envase normal	
	Pequeño	
Si pudiera, no elegiría ninguna de las opciones anteriores □		

Menos preferida	Situación 7	Más preferida
□	**Alternativa A** 1,50 €/kg **De** Calanda **con** DO Envase normal Grande	□
□	**Alternativa B** 2,50 €/kg **Fuera de** Calanda **sin** DO Envase activo Pequeño	□
□	**Alternativa C** 3,50 €/kg **De** Calanda **sin** DO Granel Medio	□
Si pudiera, no elegiría ninguna de las opciones anteriores □		

Menos preferida	Situación 8	Más preferida
□	**Alternativa A** 3,50 €/kg **Fuera de** Calanda **sin** DO Envase normal Medio	□
□	**Alternativa B** 1,50 €/kg **De** Calanda **sin** DO Envase activo Grande	□
□	**Alternativa C** 2,50 €/kg **De** Calanda **con** DO Granel Pequeño	□
Si pudiera, no elegiría ninguna de las opciones anteriores □		

Menos preferida	Situación 9	Más preferida
□	**Alternativa A** 2,50 €/kg **Fuera de** Calanda **sin** DO Envase activo Grande	□
□	**Alternativa B** 3,50 €/kg **De** Calanda **sin** DO Granel Pequeño	□
□	**Alternativa C** 1,50 €/kg **De** Calanda **con** DO Envase normal Medio	□
Si pudiera, no elegiría ninguna de las opciones anteriores □		

Características sociodemográficas: Parte III

9. Sexo:
□ Hombre □ Mujer

10. ¿Podría señalar su año de nacimiento? 19…………

11. ¿Podría indicar su nivel de estudios?

□ Estudios elementales
□ Estudios medios (Bup, FP, Bachillerato)
□ Estudios universitarios

12. ¿Cuántas personas consumen melocotón con DO Calanda en su casa, incluido Ud**?** (Indique el número de personas).

Menores de 5 años……………………..
De 11 a 20 años…………………………
De 41 a 65 años…………………………
De 6 a 10 años……………………………
De 21 a 40 años…………………………
Más de 65 años…………………………

13. ¿Podría indicar de forma aproximada el nivel de ingresos mensuales de su hogar?

□ Menos de 900€ (menos de 150.000 Ptas.)
□ De 901 a 1.500 € (de 150.001 a 250.000 Ptas.)
□ De 1.501 a 2.100 € (de 250.001 a 350.000 Ptas.)
□ De 2.101 a 3.000 € (de 350.001 a 500.00 Ptas.)
□ De 3.001 a 4.000 € (de 500.000 a 666.000 Ptas.)
□ Más de 4.000 € (más de 666.000 Ptas.)

14. ¿La actividad de la persona que realiza la compra?

□ Trabaja en casa
Trabaja fuera de casa:
□ a tiempo parcial
□ a tiempo completo

15. La casa que vivo tiene………m^2 de superficie y………(el número) de baños.

¡Le agradecemos su colaboración!
¡Aquí tiene una muestra de melocotones con DO Calanda!
Por favor, debemos hacer solo una encuesta por hogar.

Appendix 4: Survey of 2009, in Spanish

GOBIERNO DE ARAGON
Departamento de Ciencia, Tecnología y Universidad

Fecha:
Hora:

Hipermercado:
Augusta
Actur

Encuesta a consumidores de melocotones con Denominación de Origen Calanda[16]
Parte I

1. ¿Ha comprado **melocotones de la DO Calanda** en los dos últimos años?

Sí   No

2. ¿Con qué frecuencia se consume en su casa **melocotones con DO Calanda**?
(hay que poner una **X** en la opción)

- Más de 1 vez por semana
- 1 vez cada 2 semanas
- 1 vez al mes
- 1 vez en toda la temporada

3. ¿Dónde compra habitualmente los **melocotones con DO Calanda?**
(por orden de importancia, siendo **1** lo más habitual y **3** lo menos habitual)

- En los mercadillos
- Supermercados
- Productores

4. En su criterio, ¿cuál es la fruta que compraría si no encontrara el Melocotón DO Calanda en el mercado? (hay que poner una **X** en la opción)

- Otro melocotón
- Nectarina
- Naranja, mandarina
- Manzana, pera
- Melón

5. Podría valorar según su grado de acuerdo o desacuerdo las siguientes opiniones mediante una puntuación de 1 (muy en desacuerdo) a 5 (muy de acuerdo). (Hay que marcar una **X** en la opción)

	1	2	3	4	5
a) Me gusta el melocotón muy grande					
b) Los melocotones grandes tienen mejor sabor					
c) Los melocotones pequeños se conservan menos					
d) El sabor de los melocotones DO Calanda es inmejorable					
e) El melocotón con DO Calanda huele muy bien					
f) El melocotón DO Calanda tienen una óptima maduración					
g) Pago más por una DO porque sé que es auténtico					
h) Prefiero el melocotón que esté poco maduro					
i) En casa, los melocotones se estropean enseguida					
j) El melocotón envasado tiene el mismo sabor y olor					
k) No me fío de los melocotones envasados de larga vida					
l) La fruta fresca envasada perjudica la salud					
m) Tengo poco tiempo, por eso prefiero frutas envasadas					

[1] Estoy realizando este trabajo para el Centro de Investigación y Tecnología Agroalimentaria de Aragón dependiente del Gobierno de Aragón. En estricto cumplimiento con la Ley Orgánica 15/1999 de 13 de Diciembre de Protección de Datos de Carácter Personal, los datos y opiniones que nos proporcione son estrictamente anónimos. Únicamente se destinarán para el estudio científico del comportamiento del conjunto de consumidores de melocotones con Denominación de Origen (DO) Calanda, y no serán en ningún caso divulgados individualmente. Para poder evaluar correctamente sus preferencias le pedimos que responda a todas las preguntas.

Valoración de las características del melocotón - Parte II A

En esta encuesta estamos evaluando unas determinadas características de los melocotones tardíos. Las características son: el origen, el tipo de envase y el tamaño del melocotón. Y las mismas pueden variar según se observa en la tabla 1.

Tabla 1. Características del melocotón tardío para la primera valoración

El origen	El tipo de envase	El tamaño
De Calanda y **con** la D.O. Calanda	A granel	Pequeño
De Calanda y **sin** la D.O. Calanda	Envase normal	Medio
De fuera de Calanda y **sin** una D.O.	Envase activo	Grande

El origen dice dónde el melocotón fue producido (en la zona de Calanda o no) y si presenta la garantía de la Denominación de Origen (D.O.) Calanda o cualquier otra. Con relación a los melocotones envasados activos no presentarían efectos negativos para la salud y que podrían mantenerse, con la misma calidad, hasta 12 días más que los dispuestos en envases convencionales. El peso de los melocotones varía de 160 g (pequeños) a 400 g (grandes) y los medianos de 250 g. Para que usted reconozca los diferentes tipos de envase y tamaño de fruta, por favor, primero observe las muestras que están disponibles junto al encuestador.

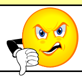
6. ¿Usted podría indicar cuál es la mejor y la peor opción de cada característica de un melocotón tardío? (hay que marcar una **X** en la opción elegida)


El origen

	Peor opción	Mejor opción
De Calanda y **con** D.O. Calanda		
De Calanda y **sin** D.O. Calanda		
De fuera de Calanda y **sin** una D.O.		


El tipo de envase

	Peor opción	Mejor opción
A granel		
Envase normal		
Envase activo		




El tamaño

	Peor opción	Mejor opción
Pequeño		
Medio		
Grande		

7. Con relación al precio, ¿cuál es el precio máximo que estaría usted dispuesto a pagar por el melocotón tardío con calidad superior (el que tiene mejor origen, tamaño y tipo de envase) y de calidad inferior (el que tiene peor origen, tamaño y tipo de envase)?

El melocotón de calidad superior	€/kg.
El melocotón de calidad inferior	€/kg.

8. ¿Qué melocotón compraría usted? (hay que marcar una **X** en la opción elegida)

El melocotón de calidad superior	
El melocotón de calidad inferior	

9. ¿Usted ha indicado que la diferencia de precio entre el melocotón calidad superior e inferior es de (   ) €/kg, ¿Qué peso asigna a cada una de las características abajo mencionadas?

Las características del melocotón:

El tamaño del melocotón	%
El origen	%
El tipo de envase	%
Total	100%

Valoración de las características del melocotón - Parte II B

Descripción del ejercicio:

En esta parte del cuestionario se le van a presentar 9 situaciones de valoración del producto. Cada una incluye 4 alternativas y cada alternativa corresponde a una característica del melocotón a un determinado nivel. En la tabla 2 están relacionados los valores que van a tomar los niveles de precios, condiciones de envasado, tamaño y orígenes de las frutas.

Tabla 2. Características del melocotón tardío para la segunda valoración

Característica	Valores		
Precio	Precio bajo (1,20 €/kg)	Precio medio (2,40 €/kg)	Precio alto (3,60 €/kg)
Origen	**De** Calanda, **con** la DO Calanda	**De** Calanda, **sin** la DO Calanda	**Fuera de** Calanda, y **sin una DO**
Tipo de envase	A granel	Envase normal	Envase activo
Tamaño	Pequeño	Medio	Grande

Por favor, asegúrese que usted haya contestado todas las alternativas. No hay respuestas correctas o incorrectas, se trata sólo de elegir las opciones según sus preferencias. Para indicar las preferencias, ponga una "**X**" en la opción más importante y otra en la menos importante que usted consideraría a la hora de comprar un melocotón.

Menos importante	Melocotón 1	Más importante
	Precio bajo (1,2 €/kg)	
	De Calanda, **con** la DO Calanda	
	A granel	
	Tamaño pequeño	

Menos importante	Melocotón 2	Más importante
	Precio bajo (1,2 €/kg)	
	De Calanda, **sin** la DO Calanda	
	Envase normal	
	Tamaño grande	

Menos importante	Melocotón 3	Más importante
	Precio bajo (1,2 €/kg)	
	Fuera de Calanda, y **sin** una DO	
	Envase activo	
	Tamaño medio	

Menos importante	Melocotón 4	Más importante
	Precio medio (2,4 €/kg)	
	De Calanda, **con** la DO Calanda	
	Envase normal	
	Tamaño medio	

Menos importante	Melocotón 5	Más importante
	Precio medio (2,4 €/kg)	
	De Calanda, **sin** la DO Calanda	
	Envase activo	
	Tamaño pequeño	

Menos importante	Melocotón 6	Más importante
	Precio medio (2,4 €/kg)	
	Fuera de Calanda, y **sin** una DO	
	A granel	
	Tamaño grande	

Menos importante	Melocotón 7	Más importante
	Precio alto (3,6 €/kg)	
	De Calanda, **con** la DO Calanda	
	Envase activo	
	Tamaño grande	

Menos importante	Melocotón 8	Más importante
	Precio alto (3,6 €/kg)	
	De Calanda, **sin** la DO Calanda	
	A granel	
	Tamaño medio	


Menos importante	Melocotón 9	Más importante
	Precio alto (3,6 €/kg)	
	Fuera de Calanda, y **sin** una DO	
	Envase normal	
	Tamaño pequeño	

Características sociodemográficas: Parte III

9. Sexo
(marcar una **X** en la opción correspondiente)

Hombre		Mujer	

10. ¿Podría señalar su año de nacimiento? 19 ____

11. ¿Podría indicar su nivel de estudios?
(marcar una **X** en la opción correspondiente)

Estudios elementales	
Estudios medios (BUP, FP, bachillerato)	
Estudios universitarios	

12. ¿Cuántas personas, incluida usted, viven en su casa y consumen melocotón con DO Calanda?
(indicar el número de personas según la edad)

Menores de 5 años		De 21 a 40 años	
De 6 a 10 años		De 41 a 65 años	
De 11 a 20 años		Más de 65 años	

13. ¿Podría indicar de forma aproximada el nivel de ingresos mensuales de su hogar?
(marcar una **X** en la opción correspondiente)

Menos de 900 € (menos de 150.000 Ptas.)	
De 901 a 1.500 € (de 150.001 a 250.000 Ptas.)	
De 1.501 a 2.100 € (de 250.001 a 350.000 Ptas.)	
De 2.101 a 3.000 € (de 350.001 a 500.000 Ptas.)	
De 3.001 a 4.000 € (de 500.001 a 666.000 Ptas.)	
Más de 4.000 € (más de 666.001 Ptas.)	

14. ¿Podría indicar la actividad de la persona que realiza las compras?
(marcar una **X** en la opción correspondiente)

Trabaja en casa a tiempo completo	
Trabaja fuera de casa	
a tiempo parcial	
a tiempo completo	

¡Le agradecemos su colaboración!
¡Aquí tiene una muestra de melocotones con DO Calanda!
Por favor, debemos hacer sólo una encuesta por hogar

Appendix 5: Information about peaches quality standards

Table A.5.1 Equivalences among diameter, circumference and caliber of peaches

Diameter[1,2]	Circumference[1,2]	Caliber (code)[2]	Caliber (fruit per box)[3]
90 mm or more	28 cm or more	AAAA	12 – 14 – 16
80 mm - < 90 mm	25 cm - < 28 cm	AAA	18
73 mm - < 80 mm	23 cm - < 25 cm	AA	20
67 mm - < 73 mm	21 cm - < 23 cm	A	22 – 24
61 mm - < 67 mm	19 cm - < 21 cm	B	26 – 35
56 mm - < 61 mm	17.5 cm - < 19 cm	C	37 – 40
51 mm - < 56 mm	16 cm - < 17.5 cm	D	42
<51 mm	<16 cm	E	45

[1]These measurements are taken from the peach's equatorial section;
[2]Source: DOUE (2004)
[3] Source: Boxes with 50 x 30 cm of dimension

Appendix 6: Aditional information about PDO Calanda peaches

Table A.6.1 Municipalities where production of Protected Designation of Origin (PDO) Calanda peaches is allowed

Municipality	Municipality	Municipality
Aguaviva	Cretas	Mequinenza
Albacete del Arzobispo	Escatrón	Molinos
Alcañiz	Fabara	Nonaspe
Alcorisa	Fayón	Oliete
Alloza	Foz. Calanda	Parras de Castellote
Andorra	Fuentespalda	Samper de Calanda
Arens de Lledó	Hijar	Sástago
Ariño	Jatiel	Seno
Berge	La Freneda	Torre de Compte
Calanda	La Ginebrosa	Urrea de Gaén
Calaceite	La Puebla de Hijar	Valderrobres
Caspe	Lledó	Valdeltormo
Castelnou	Maella	Valjunquera
Castellote	Mas de las Matas	
Chiprana	Mazaleón	

Source: BOA (2009)