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EU CONSUMERS' PERCEPTION OF FRESH-CUT FRUIT AND VEGETABLES ATTRIBUTES: A CHOICE EXPERIMENT MODEL

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Abstract: This thesis aims to study consumers' perception in relation to fresh-cut fruit and vegetables consumption. In the first part of the work, the main features of the European fresh-cut fruit and vegetables market are discussed, paying more focus on the Italian demand of fruit and vegetables. The middle part is mainly represented by a systematic review of the literature investigating factors affecting the food choice decisions of adults in relation to fruit and vegetable consumption, with more emphasis to fresh-cut produces. Finally, there is the experimental part, in which European consumers' preferences of fresh-cut fruit and vegetables are investigated through an econometric analysis.

The fresh-cut sector is constantly evolving and innovating in order to enhance quality and safety of products, which attributes are generally valued by consumers. Quality and safety are multifaceted attributes because they arise from a wide set of methods/technologies, therefore the knowledge about consumers' preferences for food technologies is still matter of debate.

The main objective of this thesis it to test whether new fresh-cut fruit and vegetables attributes influence consumers' choices and preferences. At the same time, we are able to verify the influence of socio-demographic characteristics on consumers' preferences.

A Latent Class Multinomial Logit Model has been fitted for almost 1.500 consumers of four different European countries: Greece, Italy, Spain and United Kingdom, in order to divide the consumers in different latent classes based on their choice and their characteristics.

Fresh-cut F&V consumers for the four European countries, have a similar behavior in terms of preferences. We can divide the consumers in two different latent classes: the first made by consumers that do not appreciate any fresh-cut F&V attributes, and the second that include consumers that appreciate the several fresh-cut F&V attributes. Even if the cross-country comparison of consumers' preferences has not produced substantial differences across the different countries, socio-demographic characteristics influence the perception of consumers about the consumption of fresh-cut fruit and vegetables.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION TO THE RESEARCH AREA

1.1 Introduction

Fresh-cut fruit and vegetables (F&V) that are already cleaned, trimmed, cut, washed and packed in a modified atmosphere are more and more common in consumers' market baskets. The market for fresh-cut F&V in Europe began in the early 1980's and has been characterized by a double-digit growth. More recently (2005-2010), fresh-cut F&V growth has gradually slowed from 10% to 3% (Rabobank, 2010).

Recent research on consumers' preferences confirms strong positive relationships between the choice of food and its convenience. In fact, the growing market for convenience foods relies on new life-styles, in which time-saving is one of the most important characteristics (de Boer et al., 2004). Consumer characteristics such as number of children, full time employment and disposable income, are all directly connected with perceived time budget and attitude towards convenience products (Scholderer et al., 2005). Other features influencing the choice of convenience food are age, concern about naturalness, nutrition knowledge and cooking skills (Brunner et al., 2010).

The fresh-cut sector is constantly evolving and innovating in order to enhance quality and safety of products, which are generally valued by consumers. The literature states that consumers are more sensitive to product appearance and packaging, search attributes at the time of purchase, while they are influenced by experience attributes in the consumption phase. On the other hand, other studies find fresh-cut fruit are less likely to be chosen compared to fresh fruits, holding price constant, and the main attributes important to consumers are the time in storage from the date of packaging and the country of origin (Louriero et al., 2001; Campbell et al., 2004; Viane et al.1998; Regaert et al., 2004; Jaeger et al., 2008).

Quality and safety are multifaceted attributes because they arise from a wide set of methods/technologies. In fact, consumers' preferences for food technologies are still controversial. Microbiology, chemistry, and food engineering research are working on providing new solutions in order to enhance quality and safety attributes. Shelf-life enhancement, for instance, could improve the shopping schedule plans of consumers and the logistics of supply for producers as well. On the other hand, improving shelf life means enhancing microbiological and chemical safety in order to have a product that lasts longer.

However, are technological solutions and innovations always accepted by consumers? This is a question that a number of new projects are trying to address. One of these projects is called QUAFETY EU (Quality and Safety of Ready to Eat Fresh Products), a project co-funded by the European Commission and 6 small and medium size enterprises that comprises a

multidisciplinary group of researchers working on improving fresh cut products from technical perspectives, combined with economists evaluating consumers' response to the new technologies. This project is aimed at informing the food industry about possible marketing strategies and improvements that can be introduced along the supply chain at the industrial level. The current research for the proposed paper is part of QUAFETY EU, which collected and provided the necessary data for market analyses for this research.

About the methodology used in this work, the analysis will be conducted using data collected through questionnaires administered in 2012-2013 in the four countries identified above. The questionnaire has been structured in order to collect information about consumers' characteristics, such as socio-demographic characteristics, eating and purchasing habits, as well as psychological aspects. Information about consumers' preferences was collected through a choice experiment. Choice sets were determined using QUAFETY research attributes and pricing scenarios. The use of stated choice model in agricultural economics well established in the scientific literature, with several applications in both agro-food marketing (Bai et al., 2007; Taglioni et al., 2011) and food safety (Louriero and Umberger, 2007).

1.2 Objectives

This research aims to provide an analysis of consumers' preferences towards novel attributes of fresh-cut F&V by working closely with engineers, chemists and microbiologists, in order to provide industry the best innovation path for processing fresh-cut F&V based on demand information.

Specifically, our objectives are:

a) understanding consumers' characteristics that influence the choice of fresh-cut F&V compared to fresh ones, by testing the impact of segmentation variables already defined by the literature;

b) Assessing consumers' perceptions about the attributes developed through QUAFETY research including shelf life, typology, stabilization processes, and safety indicators.

c) Estimating the willingness to pay for each attribute analysed;

The analysis is based on a European Union (EU) wide and *ad hoc* survey conducted within during the QUAFETY project, in which about 1500 Italian, Spanish, Greek and British consumers were interviewed. Therefore, our final objective is:

e) To conduct a cross-country comparison of consumers' preferences in order to target country-specific innovation paths for processing fresh-cut F&V.

In terms of expected results and managerial implications, we expect significant relationships between socio-demographic variables, such as income, number of children, full employment and consumer habits (for example weekly grocery shopping times, meal preparation time), and the choice of fresh-cut F&V.

This research will allow us to have a clearer understanding about consumer perceptions of each attribute considered in the model, and to estimate the marginal willingness to pay for each attribute. If consumers were found to prefer fresh-cut products to their fresh counterpart, it will be interesting to understand their perception about new attributes, never considered in previous research. For example, knowing the shelf life preferred by consumers would represent a useful piece of information for research on technological aspects of processing. In fact, the current direction of food processing research is oriented towards shelf life increases, but there is no consensus on whether consumers care about this product characteristic. The same implications will be developed using consumer perceptions about other new technologies adopted in the packaging process.

In addition, the choice model will allow development and comparison of profiles for typical fresh-cut F&V consumers in each of the four countries considered in this study. Results of this study will prove particularly useful for the entire EU food supply chain, especially where import-export operations are involved. Furthermore, results and implications will inform fresh-cut F&V sector about potential increases in sales and customer satisfaction.

1.3 Structure of Thesis

The entire thesis is composed by eight chapters, which a brief description will be given in the follow.

Chapter 2 gives us an introduction of fresh-cut category, referred to fruit and vegetables. The main steps of productive process are discussed, and the most important features of the European fresh-cut F&V market are shown.

Chapter 3 is about the demand estimation of fresh-cut F&V in Italy. The demand has been estimated starting from Scanner IRI data through the AIDS model. The results of this empirical work are reported.

Chapter 4 presents the theoretical background to the research area. It describes the literature about the revealed preferences techniques with more emphasis on the stated preferences techniques and in particular way the choice modelling technique.

Chapter 5 shows all the descriptive statistics of the sample with a direct comparison about the four countries analysed.

Chapter 6 embodies the central part of the work, a Discrete Choice Model applying to evaluate the fresh-cut F&V consumers' attitude and perception. Details about the data collection and choice experiment setting are revealed.

Chapter 7 is entirely dedicated to result discussion. Starting from statistical description, the Latent Class Multinomial Logit Model and the Willingness to Pay estimates are presented.

Chapter 8 presents the conclusions of this thesis. It discusses the findings in terms of addressing the research questions and the implication in the F&V sector.

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CHAPTER 2
FRESH-CUT PRODUCTS AND THEIR MARKET

2.1 Fresh-cut products

In line with the last definition given by the International Fresh-Cut Produce Association (IFPA) in the 2005, "fresh-cut produce" is defined as any fresh fruit or vegetable or any combination that has been physically altered from its original form, but remains in a fresh state. Precisely, they have been trimmed, peeled, washed and/or cut into a 100% usable product, which is subsequently bagged or pre-packaged to offer high nutrition, convenience and value to consumers while still maintaining freshness. According the National Institute for Food and Nutrition Research (INRAN) and in line with all European countries, F&V products are classified in five categories, as reported in succession:

- First category: fresh fruit and vegetables;
- Second category: canned fruit and vegetables;
- Third category: frozen fruit and vegetables;
- Fourth category: fresh-cut fruit and vegetables;
- Fifth category: precooked or grilled vegetables.

The fresh-cut process is very simple, but at same time safe and secure, thanks to a procedural guideline established by IFPA. The actions that made the entire process are:

1. Produce is harvested directly from the field and put into large bins;
2. The produce is emptied into a trim-and-core processing line to remove not-edible parts, as leaves, stems and peelings;
3. The trimmed produce is direct to a cutting machine or is hand-cut, depending on fruit and vegetables type;
4. In order to be sure all produce is uniform, an inspection is done;
5. The cut produce is abundantly washed as many as three times with refrigerated and sanitized water;
6. The washed produce is dried and packaged to preserve the freshness;
7. An average of 10-14 days is printed as a use-by code date on the package.

Origins of fresh-cut products date back at 60's in the USA in retail supermarkets with the name of "minimally processed" and ever since the presence of these products in the market became always more considerable. The born and the success of the fresh-cut products in the USA is the result of an innovation in the marketing and in the technology of fruit and vegetables sector. The great success was due in the USA to the existence of a favourable circumstance, both scientific and economic, in the American production system.

Fresh-cut F&V market arrived at Europe, and exactly in France, in the early 1980's, and then spread in all Europe, but mainly in the Countries of North Europe, as United Kingdom, Germany, Switzerland and Italy. Overall, since their introduction, the fresh-cut segment has been characterized by a continuous growth, alternated by some period of stagnation. For the entire food sector, fresh-cut F&V represent an advantageous solution to reduce the costs in the food preparation in terms of manpower, to reduce the need of appropriate system to handle waste, and the possibility to produce and deliver specific forms of fresh-cut products (Watada et al., 1996). The constant growing if F&V consumption, thanks to their benefits in the healthy and in the human well-being, is confirmed and well documented in the literature. The World Health Organization (WHO) recommends a daily intake of F&V of more than 400 grams per capita. The last *Consumption Monitor* of European Fresh Produce Association (2012) shows that overall, 2011 experienced a slight 2.6% raise in the consumption pattern to 382 g/capita/day for fresh fruits and vegetables on average for the EU-27 (Freshfel, 2013). In this context, fresh-cut sector could help to increase the F&V consumption, in order to achieve the daily recommended intake, and the proper count of vitamins, minerals and fiber. A reason of this success is certainly the high quality preserved from the products during the entire process, added to convenience offered by solution to save time (Stampacchia et al., 2008). In confirmation of this, in the supermarkets, the area reserved to fresh-cut F&V is considerably augmented in the last years: the high lifestyle justify the greater use of product ready-to-use, which the fresh-cut belong to, thanks to them convenience without to alter the organoleptic and sensorial characteristics (Gilbert, 2000). To meet these specific needs, fresh-cut F&V are also served in vending machine in the schools, in the public/private office and at workplaces, constituting an excellent solution to improve the nutritional and healthy quality of snacks in a time where illnesses related to obesity and nutrition represent a serious problem for the population (Olivas and Barbosa-Canova, 2005). Regarding this last aspect, several "educational campaigns" have been promoted as policy tools to sensitize citizens connected to nutrition-related-illnesses, even though is different the efficiency evaluated by several authors (Seiders and Petty, 2004; Gordon et al., 2006).

In definitive way, the main advantages of fresh-cut F&V are the convenience and the high quality preserved by products. These aspects are constantly examined and discussed by research, in order to improve the total quality, from the safety and packaging standpoints.

Among the disadvantages that characterize the fresh-cut sector, there is, sure as hell, the high price for the consumer compared with the fresh products (generally 5 or 6 times more). The reasons of this difference so marked in the final sale price are several and could be

connected with the productive process (the great manpower required, the great waste in the raw materials, high costs of packaging, conspicuous unsold and other factors) (Baldi and Casati, 2009). Further costs are due to the maintaining of cold-chain, given that the average shelf life of fresh-cut F&V is included from 3-4 days to 10 days (ZIPMEC, 2013).

From different years, the companies involved in the sector, have carried out important investments, but thus far, the results are not been satisfying. The investment has not had the expected economic come back and consumers are still cautious towards these products. However, according to experts, exists still a strong unexpressed potential that could be come to light in the next years (Nomisma, 2014).

2.2 Productive process of fresh-cut

Recalling the definition of fresh-cut, where fruit and vegetables have been trimmed, peeled, washed and/or cut and then packaged in way to be considered as "fresh produce", the entire fresh-cut process involves various steps, as reported in the fig.1. Each single operation is very important and essential to perform a final produce with high quality, long shelf-life and safe.

The physiology of raw produce and the stress resistance mainly influences the final quality of fresh-cut F&V: the different operations induce cut-stress and dent-stress. In the entire process, the temperature plays a role of essential importance, trying so to keep the cold chain in order to reduce the biotic contaminants and the dehydration. In succession, each of the operations will be briefly described, focusing on the important details.

- *Raw materials receiving*: fruit and vegetables addressed to cutting and peeling need to have high qualitative standards in terms of variety and selection in the harvest. The choice of a good variety is an important aspect for the structural and metabolic characteristics, while the selection is related to the cultivation technique, harvest and post-harvest technique, in order to prevent possible microbial contamination.

- *Preliminary washing and sorting*: by arriving directly from the field, fruit and vegetables arrive to the plant with dirt or dust. For this reason, it is necessary to proceed with a first inspection to remove any fruit or vegetables that show dents or signs of decay, to reduce the probability of possible contaminations. Successively, preliminary washing and then rinsing in appropriate tanks with cold sanitized water may be necessary to reduce microbial charge before cutting operation.

- *Peeling*: not all the commodities can be cut directly, but few of them, as carrots, onions and some fruits, require peeling to remove fibrous skin. This operation is considerably

improved in the last years thanks to wide range of peeling machines, almost totally replacing the hand peeling, which is used only in few cases with specific commodities.

- *Cutting*: in this phase, the edible part of commodities are trimmed into small pieces (wedges, slices or cubes). Before to do this, all the unwanted parts must be removed from the bulk commodities. This phase is undoubtedly the most delicate of the entire process, inasmuch it make the produce more susceptible to alterations as a result of cellular metabolism (respiration) and a greater exposition of unprotected surfaces to microbial attacks. The choice of knives and corers is important to reduce the cut surface and to have a regular cut, moreover knives and corers should be kept clean, sanitary and sharp.

- *Washing*: this phase follows in a short time the cutting operation, and it represents the last tool to remove dirt, dust and cellular juice from the cut surface, and to assure the absence of microorganisms that could easily grow on the produce surface. Washing takes place through special machines in cold sanitized water. So that the operation is efficient, it is necessary need to hold in check some key parameters, as water temperature, contact time, chlorine content and pH.

- *Dewatering*: removing the water after the washing is a necessary step in the whole process, because an high humidity level could compromise the storage and the shelf life of final produce. Removal of water take place mainly with two modality: centrifugation or forced air. Centrifugation, interpreted as spinning to force water to the outside of a collection vessel, is the oldest methodology of dewatering. Theoretically, it adapts to all produce, watching out for the key parameters (speed and time). An excessive centrifugation could damage the cells and cause the runoff of cell fluid, reducing so the final quality.
Forced air methodology is mainly indicated for the delicate products. It adapts better to vegetables that present smooth surfaces, to avoid that water residues are stagnant in the nooks and crannies.

- *Packaging*: the last step before the selling is the packaging of the produce. It is a fundamental action for the final quality and indispensable to preserve the freshness for the shelf-life. For the packaging, polymeric film bags and trays in many sizes, shapes and formulations are used. They hold a protective function from mechanical actions, outside contaminations, and at the same time appraise the quality. Packaging is an operation completely mechanized, where the atmosphere within the package is partially

or totally substituted with modified atmosphere. The right combination of packaging material, produce weight, gas composition, enable to increase the shelf life of produce by reducing the degradation processes without to alter the nutritional quality.

In all the process plays an important role the temperature. Is best practice to maintain the produce in a range of temperature of 5-10 °C. Higher temperature could facilitate respiration and degradation process, while lower temperature could cause cold damages.

Figure 1. Fresh-cut productive process
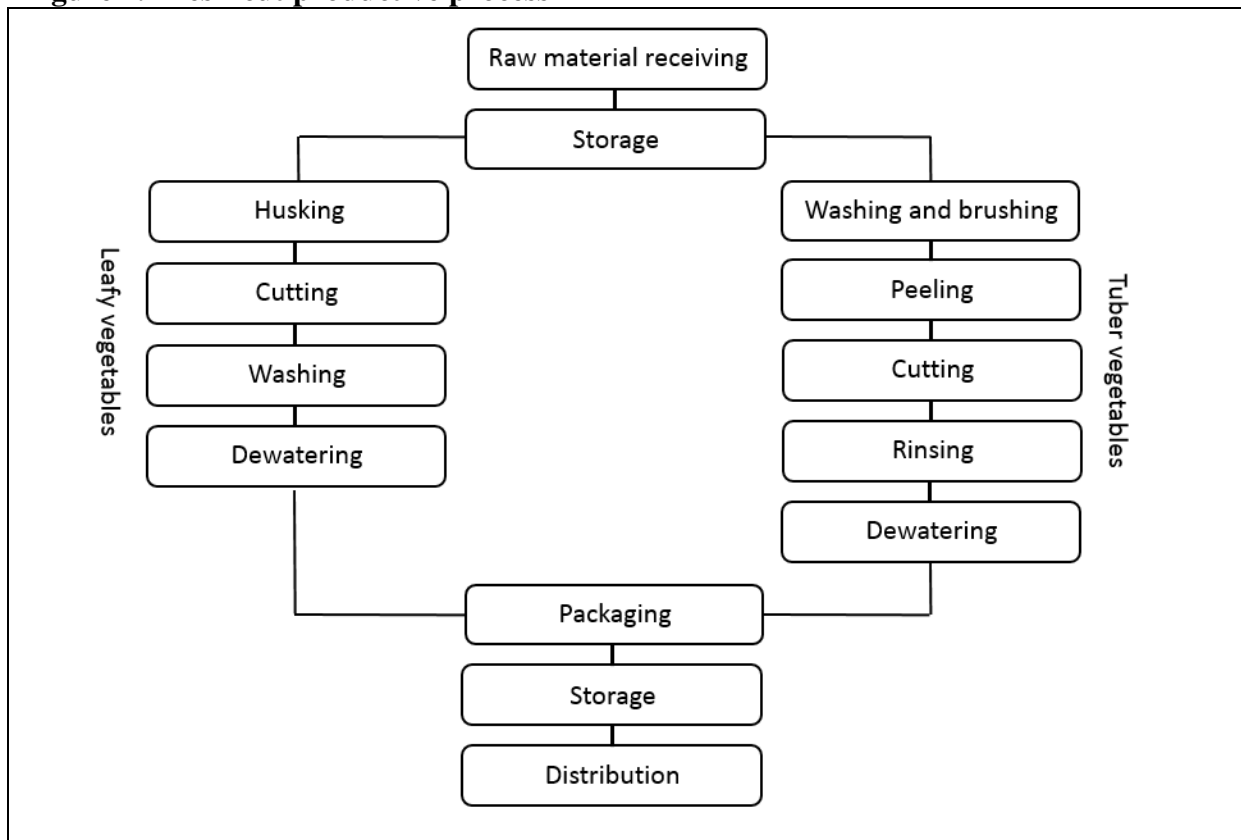
2.3 European fresh-cut F&V market

Fresh-cut produce reached the different European markets gradually. Travelling through again the introduction and the history of fresh-cut F&V in Europe, they appeared in the shelves of supermarket for the first time in France in the early 1980's thanks to Florette Holding Company, and then to be exported in other countries as United Kingdom, Italy and Switzerland. In the late 80's, they were introduced in the Spain and Portugal by the biggest salad vegetables company Vega Mayor. In the 2001, Florette purchased Vega Mayor, beginning so the major salad vegetables supplier in the Europe with the 15% of fresh-cut F&V market share (Fruitnet,

2013). Fresh-cut produce have been customized according the preferences of each country, and considering the restrictions in terms of production, distribution and legislation. For these reasons there are several brands leader in each country, according the consumers' preferences.

The market for fresh-cut F&V in Europe, since its origin, has been characterized by a double digits growth, although in the five years 2005-2010 this growth has gradually slowed down from 10% to 3%. In the 2010 the value of fresh-cut F&V market in the EU was about 3.4 billion € and according to 2010 Euromonitor forecasts, consumption of fresh-cut F&V will continue to grow until to 2015 with a constant rate of 4% (Van Rijswick, 2010). It should be noted that, despite the continuous growth of the fresh-cut F&V consumption, its market share is still represented by few percentage points. In 2010, fresh-cut fruit market share was about 1% of total volume of fruit sold in the Europe. For fresh-cut vegetables, the situation is slightly different, because the market share has increased by 4% with respect to the total volume of vegetables (Rabobank, 2011). Concerning the features of the fresh-cut F&V market, packaged salads appear to be the leader of fresh-cut products, in fact they hold about 50% of total fresh-cut market volume. The other 50% is shared by the fresh-cut fruit (10%) and the other categories as ready-to-cook, crudités and other with 40%.

To offer a brief overview of the sector in the four countries analyzed in this research, we report that the United Kingdom confirms to be the Europe's leader in the fresh-cut market sales, followed by Italy (FAO, 2010), with a production of 480.000 tons in 2008 and a value of 1.1 billion € (Florkowski, W. J. 2009), and with a retail market growth in the three years 2008-2010 of 6% in average (Nielsen, 2010). In Italy, the production of fresh-cut was been of 90.00 tons in the 2008 with a total value of 700 million € (Pirazzoli and Palmieri, 2011). In countries as Germany and Spain, in which fresh-cut F&V is still emerging, the market growth in the last years was higher than other countries in which this market is already established, for instance Italy and the Netherlands (Rabobank, 2010). In confirmation of this, the fresh-cut market value of Spain in the 2008 was 200 million €, with a growth of 4-6% per year, until to reach in 2010 a total market value of 300 million € (Van Rijswick, 2010).

Trend in consumption seems to reflect the trend of total production of F&V in the different European countries. With reference to the decade 2000-2010, as reported by the last FAO report (2013), Italy and Greece registered a decrease in the vegetable production of -2.0% and -2.4% and a -0.2% and -2.4% in fruit production, respectively. For the United Kingdom, the decrease in vegetables production (-1.8%) is in countertrend with respect to the increase in fruit production (3.2%). For Spain, F&V production remained almost unchanged (FAO, 2013).

The different food habits are at the bases of the high difference in the fresh-cut demand and consumption between the USA and the EU. The fresh-cut F&V per capita in the USA is 30 kg, in comparison with the European average that is 3 kg per capita (Nomisma, 2014). The fig. 3, shows in more detail the fresh-cut F&V consumption across the leading European countries.

Figure 2. Fresh-cut F&V segments
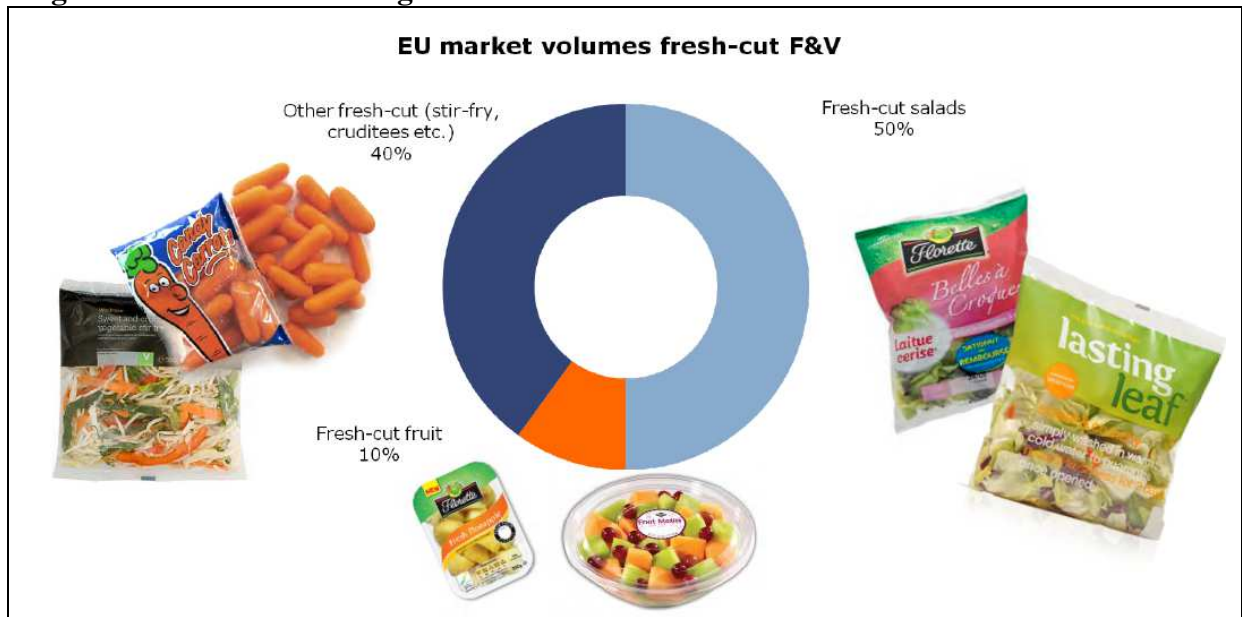
Source: Rabobank International, 2010

Figure 3. Fresh-cut F&V consumption per capita in EU (mean 2007/2010)
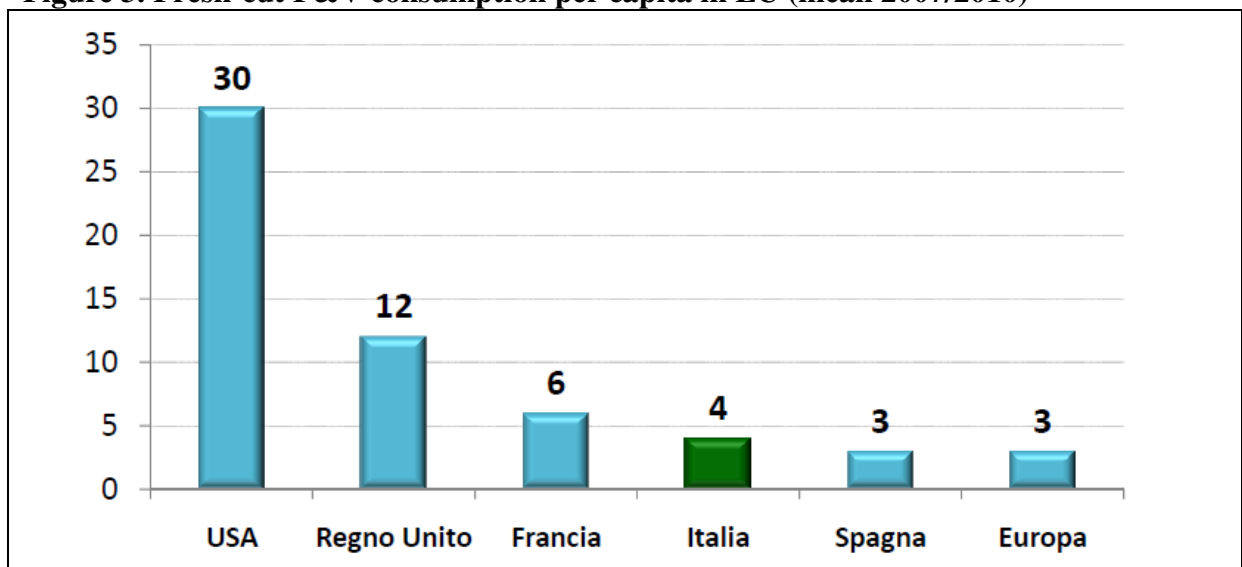
Source: DEPAAA (Dipartimento di Economia e Politica Agraria, Agroalimentare e Ambientale)

2.4 Fresh-cut consumers' attitude and perception

The research for the fresh-cut F&V quality improvement, from the safety and packaging standpoints, is constantly evolving (Watada et al., 1999; Soliva-Fortuny et al., 2002; Rico et al., 2007; Artés et al., 2009; Amodio et al., 2011). Food science research on technological developments for fresh-cut F&V opens the following question: what is consumers' perception towards quality and safety of fresh-cut F&V products?

While the literature provides a great number of studies about consumers' preferences for the quality of fresh F&V, it remains limited when it comes to minimally processed and packaged F&V. In particular, Pollard et al. (2002) completed a review that provides a rigorous investigation on the factors that affect the choice of F&V and their intake. Sensorial appeal, social interactions, costs, time constraint, personal ideology and advertising are all factors capable of influencing the choice of F&V. Several studies consisting of specific case studies for different types of F&V are also available (Loureiro et al, 2001; Harker et al. 2003; Campbell et al. 2004; Haghiri①a et al, 2009).

The literature on ready-to-use products, which includes the fresh-cut sector, provides different results according to specific attributes considered. First, it is appropriate to mention that previous studies have highlighted the existence of an inverse relationship between the family income and the consumption of F&V (Marshall et al, 1994; Cassady et al., 2007), which represents a first possible barrier for the some potential consumers of minimally processed products. Consumers to whom this first barrier does not apply, may encounter further barriers such as consumer's social environment, working time, time outside home, consumption of food in restaurant (Frewer et al. 2001; Buckley et al., 2007).

In particular, the strong relationship between the choice of food and its convenience is evident in the literature. De Boer et al., in 2004, analyzed Irish convenience food consumers through a comparison of the regression results across four convenience food categories. They found that in the category with the highest level of consumption, the frequency of purchase is positively correlated with lifestyle (social events, eating alone, breakdown of mealtimes, novelty) and time pressure, while in a negative way with interest in cooking and importance of freshness. Number of children, full-time employment and disposable income are all variables directly connected with perceived time budget and attitude to convenience products (Scholderer et al., 2005). The strongest drivers for convenience food consumption are age, concern about naturalness, nutrition knowledge, and cooking skills (Brunner T.A. et al., 2010).

The increasing interest for food labeling and consumers' positive attitude towards informational facts is confirmed by literature. Labeling and product information (nutritional, safety and technology) appear to be important attribute for consumers (Delizia et al., 2003). Cardello et al. (2007) studied consumers' perception risks associated with innovative and emerging food preservation technology, finding that "innovative technologies" often are associated with unknown heath risk, while the term "cold preservation" yields a positive utility. Interestingly, the attribute "minimally processed" has a negative utility for consumers, which may imply that products that have not been processed sufficiently are perceived as a source of microbiological or other safety risk.

Also the type of packaging seems to influence consumers' choice, in fact label information, the quality of packaging, the brand and the visual impact, are all in descending order, features evaluated by the consumers at the time of purchase (Peters-Texeira and Neela, 2005).

Jaeger and Rose in 2008, through a stated choice experiment, analyzed "eating occasions" attributes with regard of the choice of fresh fruit. First, they found that fresh-cut fruit is less likely to be chosen than fresh one, independently from the price. Second, their research reveals that the main fruit attributes that influence the choice of consumers are time of storage (date of packaging) and the country of origin. In addition, the eating occasions in which fruit is preferred to other food are while driving and while eating in public space. By contrast, fresh-cut fruit is preferred to the fresh one in those occasions in which it is eaten slowly and time is taken to linger over the food. Also Owen et al. (2002) reported that the choice of fresh fruit and vegetables is often not influenced by the price of an individual item.

Ragaert et al. (2004) analyzed the perception of minimally processed vegetables and packaged fruit, finding that search attributes (product appearance and packaging) are significantly more important in buying stage, while experience attributes (taste, odor, texture) are more important in the consumption phase. Therefore, consumers are not willing to renounce to the high quality, but they want a fair compromise between convenience and quality.

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CHAPTER 3

ITALIAN DEMAND FOR FRESH-CUT FRUIT AND VEGETABLES TROUGH SCANNER DATA

3.1 Introduction

The European market for fresh-cut fruit and vegetables was characterized by a progressive increase in trade during the decade 2000-10. This growth continued in line with the trends of other countries with mature economy. Italy is the only country to have experienced a stop in 2008 (-1,4% in volume and -3,8% in value) (Ismea-Nielsen, 2011), however, followed by a gradual resumption of trade in 2009 with an increase of 5,8% in value (€ 700 million in revenue), while the quantities amount reached 146 thousand tons, an increase of 11% compared to 2008 (Ismea, 2011).

Numerous studies have analyzed the growth and development of fresh-cut products to identify the success factors (Caccetta and Platania, 2006), or psychosocial reasons that determine consumption of both fresh fruits and vegetables (Brug et al., 1995) and fresh-cut.

On the demand side the thesis that household consumption of ready-to use products reflects the changes in the socio-demographic structure of the population seems to be confirmed, such as the reduction in the number of family members or the greater number of people following a urban lifestyles. Actually, the penetration of these products in household consumption is increasing as well as the percentage of consumers who recognize the fresh-cut produce as an ideal solution to save time (time saving) due to their ease of use and keeping the organoleptic quality and safety (Bacarella, 2002; Stampacchia et al., 2008; Baldi and Casati, 2009).

Post-modern consumers pay much emphasis on the availability of healthy and fast foods to consume to cope with the increasingly urgent rhythms of contemporary society and the personal health related interests.

Even the supply side of fresh-cut products represents an opportunity for the development of the agro-food industry, especially in the upstream supply chain. For farms, in fact, this is a factor of diversification and enhancement of products offered with recovery of added value compared to the downstream component of the supply chain. This development was also affected by the changes of new fruit and vegetable CMO, which favored the strategies of differentiation and qualification in addition to a higher efficiency of the entire fruit and vegetable sector (Cesaretti and Green, 2006; Bertazzoli and Petriccione, 2006).

Even the retailing sector has received benefits from the development of fresh-cut products. Historically suffering in the sector of fruit and vegetables, with the development of these products, the distribution has been able to adopt differentiation strategies to develop the turnover of the whole category (Sodano and Hingley, 2007).

Based on these successes, research interest focuses on the analysis of the consumer market, although some signs of slowdown in consumption at National level, as consequence of the international financial crisis, raises doubts on a further growth of the market at the same pace.

Starting from the sell-out data into the major retailing, the research aims to achieve the following objectives:

I) measuring the price effect on the demand for the fresh-cut products to analyze the effects of elasticity. The presence of a high sensitivity of demand to price movements represent an element of fragility competitiveness for companies and low profitability in the presence of price wars;

II) measuring the substitution and the complementarity effect to test the hypothesis that the positive trends of the market are due to a substitution effect between ready products and fresh products. The substitution effect is related both to the relationship between the prices of different convenience goods, and the changes in preferences. The substitution effect may also occur between different categories of fresh-cut products. However, the hypothetical complementarity between the different categories of assets remains to be verified. This effect could be interpreted as a joint increase in the sales of various goods linked to the creation of new opportunities for consumption.

In the following pages, after a qualitative analysis of the characteristics of the market, the theoretical approach, the model of analysis, the results and finally concluding remarks will be presented.

3.2 Italian market of ready-to-eat products

In Italy, fresh-cut products have been introduced during the second half of the '80s, so they represent a segment still relatively young compared to the U.S. market. However, the market shares of these products are steadily increasing since they seem to be able to satisfy new needs connected with the changing lifestyles.

The consumption of fruit and vegetable in Italy decreased by about 22% from 1998 to 2010.

On the other hand, it is widely demonstrated that the assumption of fruit and vegetables is the basis for a healthy and balanced diet, and how diets rich in vegetables have a protective function in the prevention of chronic degenerative diseases[1] (Feldesein and Tucker, 2007).

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[1] Several studies, in fact, have shown that a diet rich in F&V decreases the risk of developing some types of cancer (Lee et al., 2006), reduces mortality due to vascular disease, helps prevent diabetes (Hodge et al. , 2007) and helps to maintain a healthy body weight (Bazzano, 2006) (Pearson et al., 2009). The governments of several countries, supported by scientific evidence, have adopted a policy of information and education in order to raise awareness of the benefits associated with a diet rich in F & V, and improve eating habits of

Positive signals come from the market analysis of fresh-cut products sales where, in a time span of ten years, consumption increased, on average, by more than 200% (Ostidich, 2008). Several factors contribute to this success: the time saving factor (convenience); a greater level of quality and a longer shelf life compared to the fresh counterpart, thanks to the use of specific varieties and to appeal to the storage in a modified atmosphere.

Moreover, the new consumers' perspective towards foodborne diseases exposure allow preferring fresh-cut products because of the strict hygienic and sanitary controls on processing firms (Rico et al., 2007).

The presence of a brand, finally, allows the use of a wider set of marketing instruments compared to fresh and undifferentiated products and this promotes loyalty mechanisms that feed and stabilize the demand for convenience foods. In fact, the market for fresh-cut products is mainly characterized by private labels, which with own brand manage to gain a form of loyalty.

Since the 90's, some research focused in trying to highlight and outline the general profile of the consumer "type" of ready-to-eat products in Italy (ISMEA, 1993; Nomisma, 1994), and even today, this research is still evolving to add more specific information about the features of ready-to-eat consumer. (Colucci et al., 2012; Panza, 2013). According to previous researches, we can say that the profile of the "ready to eat F&V" consumer falls in the range 25-55 years , higher education corresponding to a higher willingness to accept packaged and processed products because of both experimental behavior and limited availability to time for cooking; household of 2-3 people.

No detailed information on supply side is provided by National bureau, such as the acreage dedicated to processed vegetables and greens, therefore it is necessary to refer to producer organizations to reconstruct estimates of the structural data. According to the information provided by the Association of Producers Organizations Unolombardia (main consortium of Producers Organizations-cut) the production phase is characterized by an integrated chain thanks to the existence of several producer organizations.

In the upstream of chain there are approximately 450 farms, while the transformation is carried out by about 80 firms. The same source give us some information about the total national area of production, that is about 6.500 hectares, mostly in the greenhouse with an

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citizens (Bloom et al., 2012). Even in Italy, initiatives to raise awareness of the risks related to poor nutrition (Frutta nelle scuole e guadagnare salute) have been promoted. These educational initiatives are one of the policy instruments classified as "information measures", whose validity and effectiveness is still debated by several authors (Gordon et al., 2006; Seiders and Petty, 2004; Mazzocchi et al. 2009).

average of 5-6 cycles of production per year. The area with a greater production is Lombardia region, which represents 31% of total national area, followed by Campania region (30%), Veneto region (11%) and Toscana region (8%).

Currently, about 40% of sales concerns mixed salads, as opposed to monotype salads, 35% of vegetables ready to cook, the remaining 25% of monotype salads and other products. The turnover of ready-to-eat market in 2011 was about 780 million euro, with a positive trend 4.4% (Largo Consumo, 2012). With regard to sales channels, the most part of sales is still managed by "large-scale retail trade" (about 86% of sales in 2009 have gone through hypermarkets and supermarkets and the remaining part through discount and free services).

The bagged salads are always the leaders of this market with a share of 85%, but in terms of trend, "Salad enriched" with kit of condiments to have recorded the strongest growth with +20% (Largo Consumo, 2012).

Bonduelle is the leader in 2012 with a turnover of approximately 225 million euro, followed by the *La Linea Verde*, with 185 million euro, both with brands of large-scale retail trade" and with their own brand *DimmidiSì*. *Bonduelle* and *La Linea Verde* hold 50% of total turnover, with the result of a strong concentration of the market (Largo Consumo, 2012).

The supply is mainly concentrated in the North – West of the Country, where there is 41% of the sales in volume (and 40% in quantity), while it is still underdeveloped in the South part, with only 12% (13% in volume). In recent years, however, even in the southern regions the share of ready-to-eat products is increasing both in quantity and value. According to Ismea - Nielsen (2011) the share of fresh-cut products on the total consumption of vegetables in 2009 was equal to 2.7% in volume and 8, 7% in value.

Starting from 2008, after nearly twenty years of growth in double digits, for the first time there has been a negative change in the market of ready-to-eat products. Since 2009, the market was impacted by strong international financial crisis with disappointing results in sales compared to past trends. However, the stability of the turnover of the sector and the subsequent slight recovery in the next biennium, seems to indicate that the market segment do not follow the common negative trend of other food products.

An element which deserves special attention is price, which first of all shows significant differences compared to price of traditional fresh vegetables and frozen foods.

In 2008, a fresh-cut product has been paid on average 8.2 €/kg compared to 1,48 €/Kg of fresh product: the average difference in the period 2002-2008 amounted to around 6.8 €/Kg. A number of important studies have already analyzed the importance of price as a barrier to entry for consumption of fruits and vegetables (Powell and Bao, 2009) rather than as a

marketing tool to attract to new consumers in the market (Glanz and Yaroch, 2004). In other cases the effect of the price has been indirectly estimated as a positive component by assessing the willingness to pay (Carpio and Isengildina Massa, 2008) or as a negative component, by analyzing the cost differences between a healthy lifestyle (which includes fruit and vegetables) compared to the modern lifestyle (Acharya, 2001).

The empirical studies carried out in Italy clearly demonstrate that the price does not represent the first element to influence purchasing decisions, as well as the socioeconomic status of the consumer does not seem to characterize the consumption of these products (Bertazzoli et al., 2005; Stampacchia et al., 2008). Consumers of South Italy, traditionally consumers of fresh products, declared that only 7.2% of them attribute to high prices of fresh-cut products compared to the fresh product the decision not to buy them, giving more importance to sensorial attributes (Bacarella, 2002).

3.3 The theoretical Model

The econometric model chosen for estimating a system of demand functions is the *Almost Ideal Demand System* (AIDS), which derives directly from a PIGLOG – *Price Indipendent Generalised Logarithm* – cost function (Deaton e Muellbauer, 1980$_a$ e 1980$_b$). The frequent use of this model in this type of analyses is due to the possibility of linearization and the adaptability to cross-section, time series and panel data. The AIDS considers market shares as dependent variables, while the log of prices and expenditure as independent variables. Dependent variables have been calculated as:

(1) $\quad w_{it} = p_{it}\, q_{it}\, /\, x_t$

where i refers to the product category, t to the corresponding time, p to price, q to the volume of sales, and x to the total expenditure for the product categories considered in the analysis.

The specification of the AIDS model, given k categories, is the following:

(2) $\quad w_{it} = \alpha_i + \sum_k \gamma_{ik} \log(\,p_{it}\,) + \beta_i \log(\,x_t/P_t\,) + \varepsilon_i$

where, given each observation at time t, we have:

- w_{it} market share of good i;
- p_{it} price of good i;
- $\log(x_t)$ total expenditure;
- $\log(P_t)$ Laspeyers price index of: $\alpha_0 + 0.5 \sum_k \sum_i \gamma_{ik} \log(p_i) \log(p_k)$;
- ε_i a vector of error distributing as $N(0,\Omega)$.

The AIDS model has been linearized by substituting $\log(P)$ with the geometric Stone index: $\log(P^*) = \sum_k w_k \log(p_k)$.

AIDS specification can be modified by applying restrictions in such a way that the theoretical properties of demand are respected: omogeneity ($\Sigma_i \gamma_{ik} = 0$) additivity ($\Sigma_i \alpha_i = 1$; $\Sigma_i \beta_i = 0$), and symmetry ($\gamma_{ik} = \gamma_{ki}$ for each i and k).

The estimation of Hicksian elasticities (eq. 3), which measure only the price effect has been conducted starting from estimated parameters of the demand system:

$$(3) \qquad \varepsilon^*_{ik} = \varepsilon_{ik} + w_j \, (1 + \beta_i \, / w_i)$$

In order to improve the prediction ability of the model, other variables have been included in the model, such as the percentage of promotional activities, the inflation rate and the consumption price index and a sin function able to capture the seasonality of demand.

Estimation has been carried out through a SUR – Seemingly Unrelated Regression model, firstly proposed by Zellner in 1962.

3.4 Data and the empirical model

The econometric analysis of fresh and ready to eat fruit and vegetables has been conducted using scanner data. Information concern the population of grocery stores across Italy. Data has been collected monthly over the period 2008-2010 by *Symphony IRI* and divided by area *Nielsen*. More specifically, the *dataset* has been structured into ten product categories. Six categories refer to ready to eat and fresh-cut products, while the others are concern fresh vegetables. The fresh-cut and ready to eat products are the following: enriched salads (salads with dressing), ready-to-cook vegetables, cruditès (raw greens), baby leaf salads, monotype salads and mixed salads. Fresh products categories, on the other hand, include: salads, greens, dry legumes and a final aggregate including what is not considered in the other categories(called "other vegetables").

At each category that data includes the following information:
- monthly sales volumes (q_i),
- average price of the month (p_i),
- monthly market share (w_i).

The preliminary analysis of data highlights that Italian ready to eat and fresh cut market has a positive trend. The two years observed recorded an 11% increase in sales. Similarly, prices have raise as well, moving from about 6 €/kg in 2008 up to 7 €/kg at the end of 2010. Meanwhile, the fresh products market has registered a negative trend, although the dimension of the two markets is 1 to 10.

3.5 Estimation AIDS results

The table 1 shows the values of the estimate of AIDS model, applied on two-year data 2008-2010 of the vegetable Italian market, subdivided into ten categories, as described previously.

The goodness of fit of the model is expressed by *R squared* with a value ranging between 0.76 and 0.96 for each equation set in the system. Furthermore, it should be added that, about 60% of the 45 free parameters estimated by the model are statistically significant at least to 10%. Each value of the coefficient is interpreted in terms of percentage change in the purchased quantity of good *k*, respect to the change of one percentage point of the price *p* of the good *i*. This value is calculated thanks to inverse relationship $(\exp(\log P_{ik}) - 1)*100$.

With reference to fresh vegetables, the value and the sign of the coefficients in the equations of the system, bring out that the behavior of these categories related to the change of the price of vegetables ready to eat products, it is not unique and one-way. This statement means that the two segments market are not connected by a direct relationship. A change in the market shares of fresh products between -5.4% ($\log P_{68} = -0.055$) and +3.5% ($\log P_{510} = 0.035$), follows to an increase in the price of the ready to eat products. Excluding the presence of a factor of substitution, the changes in the fresh categories are certainly dictated by other external factors and not by direct competition with the ready to eat categories.

The interpretation of the coefficients related to ready to eat categories is different, because with a percentage point change in the several categories, we have a less marked decrease in the market shares of the same categories, except for *baby leaf* category which show an increase in the sales of 2.6% further to the increase of a percentage point of the *enriched salads*.

Also in the case of *crudités* it is possible to state that the price is not a decisive factor which drives and influences the purchases of different categories, so the existence of a factor of substitution between the ready-to-eat products is to be excluded. The price increase in a category, never leads to a purchase decrease of the same category, for the benefit of other potentially replaceable ones. In this way, if the consumer decides to not buy a ready-to-eat product because of its price, he does not replace it with another one.

The coefficients among the several categories of fresh vegetables, show less significant changes. Among these, the coefficient $\log P_{89}$ (0.024) should be emphasized, which represents a increase of 2.4% in the *legumes* in response to an average increase of 1% in the *greens* price.

Among the variables considered in the empirical model, the *seasonality* turns out to be statistically significant for most of the categories, confirming that this factor is decisive and that it may influence the demand of vegetables. At the same way, the *production* is an influential factor in the demand, mostly for the *baby leaf* and for f*resh salads*.

These results allow to confirm that the positive trend in the Italian market of ready-to-eat vegetables is not due to a factor of substitution between the ready-to-eat product and the fresh products. The positive trend could be controlled and influenced by other variables, which may be high quality and *convenience* of products, changes of lifestyle, greater purchases in store with more ready-to-eat products, and other variables. Moreover, the result of greater purchases and consumption of ready-to-eat vegetables, without negatively affecting the fresh segment, could be the results of a greater attention to food quality.

3.6 Elasticity of Demand

The expressed values by the diagonal in the table 2 represent the Hicksian elasticity of demand related to price. As regard the elasticity of the ready-to-eat products, it is not possible to treat all categories together, because of their different behaviour. The category of the *enriched* salads is the only with an elastic demand, confirmed by a highly statistically significant coefficient equal to -1.45. It indicates that with a decrease in price, we have a more than proportional increase in the purchases, followed by an increase in the total revenues. In this case, the positive trend in the purchases of this category could be attribute to the price factor. For the other categories, the situation seems to be quite different, because the estimated coefficients for the elasticity of the *baby leaf* and of the *mixed* salads, are not statistically significant, disproving the presence of a price effect on the bases of the positive trend of these two categories. The categories of *ready-to-cook* vegetables, *cruditès* vegetables and *mixed* salads, are represented by a positive sign in their coefficients, interpreted as an increase in the purchased quantities as a result of an increase in the price. Should be noted that this interpretation is influenced by other external variables which can support the purchase of these products though the price tends to increase.

Also fresh vegetable demand turns out to be inelastic where the only statistically significant coefficient belongs to *legumes* (-0.65), which has an absolute value less than one, and therefore greater total revenues.

The cross elasticity of the demand related to price among the different ready-to-eat vegetables is statistically significant only for some combinations of products, in which it is possible to verify whether they are substitutes or complementary goods. The negative value present between the pairs of *baby leaf – ready-to-cook* vegetables (-0.94), and among the *mixed* salads with *ready-to-cook* vegetables (-0.23), *crudités* (-0.84) and *baby leaf* (-0.30), confirms the presence of a complementary factor, reinforced the previous result obtained by the estimate

of AIDS model. The only positive coefficient (2.40) belongs to pair of *enriched* salads and *baby leaf*, indicating them as substitutes goods.

From the analysis of cross elasticity among the ready-to-eat products and the fresh ones, we can see that most of the coefficients has negative sign, confirming that, between the two sections of vegetables, mainly exists a relationship of complementarity and not substitution. This relationship seems to be strongly present in the following combinations: fresh salads and *enriched* salads (-3.23), fresh legumes and *cruditè*s (-0.85), fresh legumes and *mixed* salads (-0.74), fresh greens and *ready-to-cook* vegetables(-0.45). Moreover, all categories of ready-to-eat products are complementary to the last category of fresh product, called *other vegetables*. The substitution relationship belongs to following couples of products: fresh salads and *monotype* salads (0.61), fresh salads and *mixed* salads (0.47), fresh legumes and *enriched* salads (2.48), fresh greens and *enriched* salads (1.06). The majority of the signs of the cross elasticity among the different categories of the fresh segment, is intuitively negative, confirming that the different fresh products are complementary goods, with the only exception of the legumes and the greens with a coefficient equal to 1.46.

3.7 Conclusions

The two-year period 2008 - 2010 showed for the Italian vegetable fresh-cut market a positive trend with increase in consumption of 11%. This market was analyzed by the model LA/AIDS, in order to estimate the change in the market shares of the different product categories to vary the price factor and to check for a possible substitution effect between the different product categories.

In general we can say that between the two compartments, to fresh-cut and the fresh, there is not a real relationship, but it seems that the two markets are little influenced. In fact, an increase in the price of ready-to-eat products does not involve a decrease in purchases, and therefore does not give part of the shares at the market of fresh products. Simultaneously, the model suggests that to an increase in the prices of fresh-cut categories corresponds a consequent increase in sales, confirming that the independent variable price is a deciding factor in consumer choice as a substitute for information on quality and safety.

Moreover, other independent variables take over, such as seasonality and production of seasonal vegetables, which complicate the interpretation of results and make it difficult synthesis. This result supports the hypothesis that the growth of Italian-cut vegetable market is not due to a price factor stressed by the large distribution companies.

The calculation of price demand elasticity of the different categories belonging to the two vegetables sectors, underlined a similar behavior of the two sectors regarding to the prices increasing in their respective categories, because demand does not appear to be elastic to any of the products under consideration, except for *enriched* salads (but they represent a small portion of the entire market). The cross-elasticity of demand to price in the fresh-cut sector has produced more detailed conclusions, providing information on the substitution or complementarity relationship between the different products. The fresh-cut products are mainly characterized by a complementarity factor, except for the combination *enriched* salads - *baby leaf* salads, which seem to be governed by a replacement ratio. The results of the cross elasticity between the two compartments, reinforce the conclusion that there is not a relation of substitution between different products, with the sole exception of the salads category, in which the price factor plays a decisive role in the ultimate decision of the consumer in giving or not the ease of use offered by the product, fresh-cut salads. It is also possible to state that the fresh-cut represent innovative products to consumers, well-judged not replace and do not directly interfere with the fresh product.

The knowledge of the substitution and complementarity relationship between the different fruit and vegetables fresh-cut and fresh products, may be exploited directly by the operators of retail sector to manage prices and schedule any offers in the market. Furthermore, the increase in consumption of horticultural products packaged without interfering with the fresh vegetable market, recorded an increase of consumption in the period of reference, can be interpreted as a slight change in the diet of Italian food, the result of an increased focus on health or a change of lifestyle.

Tab. 1 – Estimation results

					Equations					
	eq. 1	eq.2	eq.3	eq.4	eq.5	eq.6	eq.7	eq.8	eq.9	eq.10 With restriction
α	0.374***	0.164	0.133*	-0.031	0.036	-0.09	0.599***	-0.288	0.238**	-0.136
	(-3.68)	(-1.38)	(-1.77)	(-0.21)	(-0.54)	(-0.72)	(-5.04)	(-1.22)	-2.21	(-0.53)
logP1	-0.006	_	_	_	_	_	_	_	_	-0.024***
	(-0.99)									(-2.9)
logP2	-0.002	0.039***	_	_	_	_	_	_	_	0.016*
	(-0.94)	(-11.49)								-1.9
logP3	-0.002	0	0.030***	_	_	_	_	_	_	-0.003
	(-0.44)	(-0.49)	(-6.61)							(-0.42)
logP4	0.026***	-0.024***	-0.006	-0.110***	_	_	_	_	_	0.035***
	(-3.388)	(-9.14)	(-0.75)	(-4.06)						(-3.03)
logP5	0	-0.002	0.002	-0.003	0.024***	_	_	_	_	-0.020***
	(-0.16)	(-1.55)	(-0.83)	(-0.39)	(-7.72)					(-3.17)
logP6	0.006	-0.006**	-0.012*	-0.033*	0.001	0.196***	_	_	_	-0.025**
	(-0.84)	(-2.35)	(-1.93)	(-1.71)	(-0.13)	(-5.67)				(-2.25)
logP7	-0.035***	0.003	0.006	-0.006	0.011**	0.034***	0.102***	_	_	-0.058***
	(-5.63)	(-1.35)	(-1.23)	(-0.46)	(-2.44)	(-2.85)	(-8.59)			(-5.55)
logP8	0.027***	-0.008	-0.012*	-0.065***	-0.003	-0.055***	-0.020*	0.138***	_	-0.024
	(-3.02)	(-1.46)	(-1.94)	(-5.33)	(-0.54)	(-4.72)	(-1.69)	(-4.62)		(-1.09)
logP9	0.011**	-0.012***	-0.002	0.025***	0. 004	-0.004	-0.024***	0.024***	-0.017*	-0.036***
	(-2.29)	(-5.72)	(-0.52)	(-2.78)	(-1.25)	(-0.52)	(-3.67)	(-2.61)	(-2.26)	(-3.64)
logP10	_	_	_	_	_	_	_	_	_	0.213***
										-7.99
β	-0.020***	-0.006	-0.006	0.005	-0.002	0.009	-0.258***	0.039***	-0.013**	0.0184
	(-3.79)	(-0.89)	(-1.55)	(-0.58)	(-0.41)	(-1.32)	(-3.91)	(-3.02)	(-2.09)	-1.32
var%IPC	0.007***	0	-0.002	0.003	0	-0.004	-0.004*	0.011*	-0.001	_
	(-2.65)	(-0.1)	(-1.02)	(-0.95)	(-0.20)	(-1.55)	(-1.69)	(-1.67)	(-0.37)	
season	4.01E-09	-1.72e-08***	1.17E-09	2.01e-08***	4.74e-09*	2.63E-09	4.48E-10	-2.73e-08***	8.73e-09***	_
	(-1.19)	(-3.10)	(-0.51)	(-4.78)	(-1.9)	(-0.72)	(-0.13)	(-2.93)	(-2.79)	
prod.	0	0.003	0.002	0.006**	-0.001	0.003	-0.006***	0.001	0	_
	(-1.31)	(-0.89)	(-1.4)	(-2.55)	(-0.65)	(-1.48)	(-3.18)	(-0.21)	(-0.14)	
trend	0	0	0	0	0	0	-0.001**	0.001	-0.001**	_
	(-1.31)	(-0.6)	(-0.67)	(-0.47)	(-0.05)	(-1.59)	(-2.35)	(-1.26)	(-2.42)	
R-squared	0.8932	0.9232	0.7576	0.98	0.9474	0.9609	0.9619	0.7769	0.963	

Source: our elaborations from *Symphony* IRI data (student *t* value in parenthesis)

(* significant at 90%; ** significant at 95%; *** significant at 99%)

Tab. 2 – Hicksian Elasticities

		Price									
		enriched	To cook	raw	baby leaf	onetype	mix	salads	legumes	vegetables	other
		Ready to use	Ready to use	Ready to use	Ready to use	Ready to use	Ready to use	fresh	fresh	fresh	fresh
Quantity	enriched	-1.454***	-0.181	-0.159	2.404***	-0.045	0.537	-3.230**	2.481***	1.062**	-2.299***
	salads	(-2.75)	(-0.94)	(-0.44)	(-3.38)	(-0.16)	(-0.84)	(-5.36)	(-3.02)	(-2.29)	(-2.90)
	ready-to-cook	-0.078	0.521***	0.03	-0.942***	-0.09	-0.234**	0.123	-0.324	-0.454***	0.448*
	vegetables	(-0.94)	(-3.93)	(-0.49)	(-9.14)	(-1.55)	(-2.35)	(-1.35)	(-1.46)	(-5.72)	(-1.9)
	crudités	-0.116	-0.052	1.015***	0.386	-0.153	-0.843*	-0.437	-0.854*	0.149	-0.201
		(-0.44)	(-0.49)	(-3.33)	(-0.75)	(-0.83)	(-1.93)	(-1.23)	(-1.94)	(-0.52)	(-0.42)
	baby leaf	0.236***	-0.222***	-0.052	0.01	-0.024	-0.303*	-0.059	0.596***	0.223***	0.321***
	salads	(-3.38)	(-9.14)	(-0.75)	(-0.04)	(-0.39)	(-1.71)	(-0.46)	(-5.33)	(-2.78)	(-3.03)
	monotype	0.027	-0.132	0.129*	-0.149	0.341**	0.387	0.616**	-0.193	0.227	-1.139***
	salads	(-0.16)	(-1.55)	(-0.83)	(-0.39)	(-1.96)	(-0.13)	(-2.44)	(-0.54)	(-1.25)	(-3.17)
	mixed	0.077	-0.080**	-0.166*	-0.440*	0.009	0.274	0.446***	-0.738***	-0.051	-0.330**
	salads	(-0.84)	(-2.35)	(-1.93)	(-1.71)	(-0.13)	(-1.22)	(-2.85)	(-4.72)	(-0.52)	(-2.25)
	Fresh	-0.307***	0.028	-0.057	-0.057	0.096**	0.297***	-0.101	-0.175*	-0.214***	-0.509***
	salads	(-5.63)	(-1.35)	(-1.23)	(-0.46)	(-2.44)	(-2.85)	(-0.96)	(-1.68)	(-3.67)	(-5.55)
	fresh	0.067***	-0.021	-0.032*	-0.163***	-0.008	-0.139***	-0.139***	-0.654***	0.061***	-0.601
	legumines	(-3.02)	(-1.46)	(-1.94)	(-5.33)	(-0.54)	(-4.72)	(-4.72)	(-8.72)	(-2.61)	(-1.09)
	fresh	0.690**	-0.707***	0.134*	1.500***	0.241	-0.232	-1.464***	1.466**	-0.009	-2.155***
	greens	(-2.29)	(-5.72)	(-0.52)	(-2.78)	(-1.25)	(-0.52)	(-3.67)	(-2.61)	(-0.02)	(-3.64)
	other	-0.116***	0.054*	-0.014	-0.165***	-0.094***	-0.117**	-0.270***	-0.114	-0.167***	-0.003
	vegetables	(-2.90)	(-1.9)	(-0.42)	(-3.03)	(-3.17)	(-2.25)	(-5.55)	(-1.09)	(-3.64)	(-0.02)

Source: our elaborations from *Symphony* IRI data (student *t* value in parenthesis)

(* significant at 90%; ** significant at 95%; *** significant at 99%)

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CHAPTER 4

ELICITING CONSUMERS PREFERENCES THROUGH STATED PREFERENCES

4.1 Introduction

Studying and assessing consumer preferences is one of the major activity in the branch of economics about consumer research. The market offers always more new goods and services, often with new attributes. In this continue evolution, everyone involved in the system wants to know what consumers think about the novelty and new products. Recalling a statement of Louvriere et al. in 2000, "*understanding the behaviour intentions of individual to the actions of business and government will always be of interest to a wide spectrum of society*". The area of application is sufficiently wide, involving economic, political, health, social and marketing issues. Thus, knowing, individuals' preferences could be useful and helpful to adopt specific choices or policies, to modify and adapt them, to set social policies, and to assess the acceptability degree of goods and services among the people.

Focus the attention on the economic application area, measuring consumers' preferences means to convert the choice and the acceptability of a goods or service in economic terms. This is possible thanks to an economic tool called Willingness-to-pay (WTP), in other word, it allows to measure how much consumers are willing to pay for a good or service in public and private sector. The ability to elicit consumers' preferences is commonly called with the name of "conjoint analysis", understood as a technique able to transform the subjective responses into estimated parameters (Green and Srinivasan, 1978). Consumers' responses can originate from two sources: *revealed preferences* and *stated preferences*, each with their pro and cons. The main difference is the origin of the data, while the former are obtained from real selling data in the past, the second can be considered *purchasing intention*, inasmuch they are collected through opportune surveys.

In the literature the best classification of different methods to measure the consumers' preferences according the WTP, is that provided by Bateman et al. (2002) and revised by Kjaer (2005) and reported at the bottom of the paragraph.

Given that all the work will be found only on the stated preferences, is opportune to give a definition. Term "stated preferences" refers to statement of respondent when he is asked to rank, rate or choose between different products or services options, which are made up of a number of attribute mixes (Abley J.S., 2002). According Swanson (1998), the technique of stated preferences could be mainly used for three purposes: to estimate preference functions, to forecast market share and to study market segmentation. A further strength of stated preferences tool is that you can use it also in hypothetical market, with a hypothetical good or

service. Is not always possible to have real-evidence on consumers' preferences to make an assessment and the following choice.

In this chapter, a brief description of all stated preferences techniques will be provided, focusing on the choice experiment and explaining the theory that support them.

Figure 4. Willingness-to-pay methods
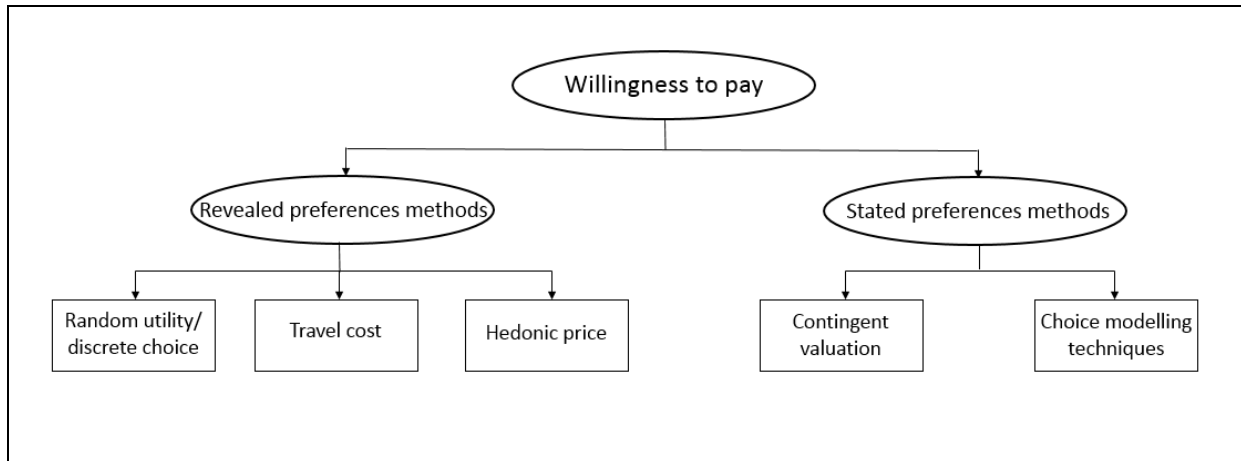
Source: Bateman et al. (2000), Kjaer (2005).

4.2 Revealed Preference Techniques

As reported in the fig. 4, the revealed preferences methods are represented by hedonic price, travel cost and discrete choice. All three methods have in common that they are indirect methods and their nature of data, they are real data deriving from real market. According Kjaer (2005), the use of revealed preferences methods have the advantage that the external validity is maximised because the choice observed are real market choice validated by a money flow. Disadvantages are embodied in the limit to supply information regarding values that have been experienced; limit in the number of classes when non-market goods are related to market goods; and in the choice set, the attribute of the choice and the individual characteristics are not designed a *priori*.

A little description of the three revealed preferences methods will be provided.

The *hedonic price* method, according Lancaster's theory (1966), a good or service is made by a set of attributes and the value of a good is considered as a function of each attribute of the same good. Given that not all attribute can be observed directly in the real market, the value of some attributes is represented by the implicit price (hedonic price). Mainly, hedonic price is used for the estimation of environmental resource. Considering a bundle of goods in which the environmental resource could represent an attribute of interest, they could be sold at different

prices. Through a direct comparison with other goods, having the same attributes except the presence of the environmental resource, you are able to determinate the economic value for the attribute of interest. The main disadvantage of this methodology is the multicollinearity between the prices and explanatory variables.

Travel cost method is mainly used in environmental valuation for non-market goods (i.e. recreational sites, fishing, hunting, boating, etc.) (Bateman et al., 2002). Travel cost method is based on consumption behaviour in a specific market, considering the travel cost as a measure of the preferences for that good. Travel cost is converted in willingness-to-pay for a service or good which is available at constant price. The procedure to apply the travel cost method envisages different steps, where the individuals are segmented in different zones and travel distance, thus travel cost for each zone is estimated. From these data is possible to know the WTP in terms of travel costs, from which to estimate the demand curve and to show how it changes with the cost of access or when fixed prices variation. According Kjaer (2005), when the price of access for a good or service increases (i.e. travel cost), the number of consumers for that service or good tend to fall. The main advantages for this methodology is that it is based on the actual behaviour, is relatively inexpensive and results are very easy to interpret.

The last method classified in the revealed preferences is the *discrete choice* analysis. The use of this method is enough wide and it falls both in revealed preferences methods and in stated preferences methods. It is used to predict individuals' behaviour (stated preferences) or to draw inferences about welfare change on the base of observed choices (revealed preferences) (McFadden, 1973; Freeman et al., 2014). Placed in front of a choice, consumers make a trade-off among the characteristics of good or service and their costs. By analysing the choices, it is possible to estimate the benefits form the characteristics of good or service, and indirectly to estimate the WTP for the same good or service. Discrete choice model is the modelling approach more used to estimate, in an indirect way, the WTP for the public transport (bus, rail, metro). In this case, you can consider as explanatory variables both the consumers' characteristics (gender, age, etc.), journey's characteristics (travel time, fares, etc.) and transport facility (comfort, convenience, safety, etc.).

All the theory behind the discrete choice model will be examined in depth in the chapter entirely dedicated to choice model method.

4.3 Stated Preference Techniques

Following always the classification showed in fig X, the family of stated preferences techniques can be divided in two branches: Contingent Valuation Methods (CVM) and Choice Modelling technique including Discrete Choice Experiment (DCE).

Developed in the USA in the 1960s, CVM is direct survey method, able to estimate consumers' preferences mainly in the environmental economics. CVM technique is based on an appropriate questionnaire designing to describe a hypothetical market where a good or service are treated. CVM requires a large and representative sample, to which is asked to state their maximum willingness to pay or their minimum willingness to accept (WTA) for a good or service or for a hypothetical change of it. In this way, stated WTP are related to respondents' underlying preference in a consistent manner (Hanley et al., 2001). The sum of the WTP represents the social preference function against which the possible outcomes of the proposal can be weighted (Bruce, 2006).

Seems that the original form of CVM was simply an *open-ended question*, for instance "How much are you willing to pay?" The open-ended question are today rarely used because of the difficulty for the respondents in the answer about the willingness to pay or accept for a non-market good or service. This problem could bring to a biased estimation of real economic value for the same good or service. It is easier to state a preference over the other, but not to state the WTP (CIE, 2001).

To elude this problem, the most part of CVM studies prefer to use *referendum* or *dichotomous choice* elicitation. In this way, the preferences are generated by using a binary choice, where the respondents have to answer only yes or no to a choice, adopting the random utility function. Moreover, also the dichotomous approach seems to have limitations, mainly about the large sample size required because of the small information collected from each individual. Overall, CVM presents some limitations to estimate the value of a good or service. Firstly, only one scenario can be present to the respondents; secondly, the estimation could be biased because of respondents are unlike to provide an accurate response with a hypothetical scenario; and lastly, some respondents could adopt a strategic behaviour (free rider), mainly when public goods are involved.

The other branch of stated preferences methods is embodied by *multi-attribute valuation* (MAV), which includes the DCE. The biggest difference between the CVM and DCE is that the first does not provide information about the different attributes that comprise the good or service, while DCE method allows estimating the values of each single attribute considered.

Multi-attribute valuation, as the name suggests, is a set of techniques where goods or services are described in terms of all their attributes. Respondents are placed in front of a series of alternatives, differentiated for attributes and levels, and they are asked to make a choice by ranking the different alternatives or by rating them. In this way, it is possible to know both the preferred choice for a respondent, but also how much is preferred one choice related to others. Usually, among the attributes are considered also the price, thus the WTP can be estimated. MAV represents an efficient tool to evaluate the attribute of a good or service and the marginal change in their characteristics. Bateman et al. (2002) identify in the MAV the following advantages: it is closer to real situation because it can consider more than two alternatives in the choice; it is easier to pool with cost models and hedonic price model given that multi-attributes designs are based on the attribute theory of value; multicollinearity problem could be reduce thanks to attribute levels that are usually designed as orthogonal, and finally, the respondents could have less difficulties in the response because they have to make a choice among different alternatives.

4.4 Choice modelling Techniques

Within the stated preferences techniques there are the family of choice modelling techniques, based on the principle that all the goods or services can be described in terms of their characteristics or attributes, and in terms of different levels that compose it. With this tool, the respondents can evaluate each single attribute of the good or services thank to the possibility to evaluate and decide which mutually exclusive and multi-attribute alternative they prefer. Their choice is based on a series of option in which different alternatives are described by a number of attributes offered at different levels. This methodology was widely used to evaluate and to study consumers' preferences in different fields. In the food system, a good can be evaluated in terms of quality, taste, odour, price, convenience, technology, etc. One of the sector in which the choice model experiment found a wide application is the transport sector in which you can evaluate the single attribute as timing, comfort, price, etc.

The family of choice modelling techniques is composed by four methodologies, which reflect methods of analysis and experimental design (Adamowicz and Boxall, 2001; Baetman et al., 2002; Kjaer, 2005):

- Discrete choice experiments (DCE)
- Contigent ranking
- Contingent rating

- Paired comparison

In the *DCE*, respondents are placed in front of series of two or more alternatives, in which they have to choose only one. In the experiment, the choice is required more times, changing the composition and the sequence of the alternatives, both for the attributes and for the levels. The theory of DCE envisages the presence of a *status quo* among the alternatives. This is necessary to give the possibility of an opt-out option within the set of alternatives, which can be chosen if the respondent is not intending to choose none of the alternatives presented. Usually, among the attributes considered in the choice, is also considered price/cost attribute and respondent are asked to do a trade-off between changes in the levels of a set of attributes. Thanks this trade-off data, the researcher can calculate and evaluate the willingness to pay or accept for that sequence of attributes. A limit of this methodology is that, through DCE is possible to collect only information about the alternatives chosen, and not the full ranking of alternatives. Despite that, the econometric technique used in DCE can be represented in a way that is exactly parallel to economic theory of rational, probabilistic choice (Bateman et al., 2002).

The methodology of *contingent ranking* differs from DCE because the respondent is asked to rank all of the alternative options present in the choice and this allows to order the data. As Louviere et al. said (2000), even if the contingent ranking data are richer in terms of information, they are more cognitively demanding. First, contingent ranking can also be approached as a sequential choice process where respondents are first asked to choose the most preferred option among the total of N alternatives. Second, the chosen option is removed from the set of alternatives and the respondents are asked to choose again the most preferred option among the remaining N-1 alternatives. As the DCE, also the contingent ranking must include in the alternative options a *status quo* or *choose none*.

The *contingent rating* experiment consists in to present to respondents one alternative at a time and to ask them to rate each alternative on a numeric scale, usually from 1 to 10. Each respondent may give a score for each alternative observed in which the attributes vary among the different alternative options. The data that the researcher can obtain from this methodology are ordered, but could be said that the degree of complexity is higher, compared the contingent ranking and DCE, because the respondents have to place a value for each alternative. A further advantage of this methodology, is that contingent rating does not involve direct comparison among alternatives, allowing respondents to score all the alternatives in equal way.

The last methodology belonging to choice modelling techniques is the *paired comparison*, in which the respondents are asked to choose their preferred alternative between two choices and to indicate the strength of their preference in a numeric or semantic scale. In this way, this

approach results to be a combination of a DCE and rating experiment where a respondent chooses the most preferred alternative and furthermore rates its strength of preference.

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CHAPTER 5

FRESH-CUT FRUIT AND VEGETABLES CONSUMERS: THE SAMPLE

5.1 Descriptive statistics

In this chapter, the main descriptive statistics on the consumption of fruit and vegetable are described, whit a greater focus to the fruit and vegetable ready-to-eat consumption. The data based on these statistics come from questionnaires administered in four European countries: Italy, United Kingdom, Spain and Greece.

The data have been collected by the same questionnaire, made in three section (purchases and consumption, purchasing behavior, socio-demographic characteristics). The main differences will be highlighted in order to understand and analyze the different habits and preferences among the different countries.

In the first section of this work, an overview on the socio demographic characteristics of different countries will follow.

Table 3. Main socio-demographic characteristics (percentage of interviewed consumers)

characteristic	group	Italy	U.K.	Spain	Greece
Gender	male	31.7	47.1	47.2	49.0
	female	68.3	52.9	52.8	51.0
Age	18-30 years	23.8	21.4	22.0	27.2
	31-40 years	22.8	17.3	25.2	22.3
	41-50 years	14.7	20.4	22.8	22.3
	51-60 years	19.0	21.0	18.4	19.3
	>60 years	19.8	19.8	11.6	8.9
Education	Primary	4.5	1.6	3.6	0.5
	Secondary	18.2	26.8	13.2	4.0
	Advanced	25.5	27.8	32.4	24.2
	Degree	18.9	29.9	29.2	18.3
	Master	9.1	10.3	14.0	32.7
	Postgraduate	2.8	3.6	7.6	20.3
Employment	entrepreneur/Freelance	15.0	8.7	8.8	20.3
	public/private sector director	1.2	3.8	2.4	6.4
	public/private sector employee	27.3	39.5	33.2	35.6
	workman/artisan	8.5	6.5	9.6	1.5
	retired	13.7	18.7	6.0	11.9
	unemployed	4.4	9.3	22.0	11.4
	student	11.3	4.0	8.4	5.4
	housewife	18.6	9.5	9.6	7.4
Family	1 member	19.2	19.2	8.0	7.4
	2 members	25.1	33.1	29.2	24.3
	3 members	20.8	17.7	28.4	2.8
	4 members	29.1	20.0	23.6	35.6
	>4 members	5.7	9.9	10.8	11.9

Analyzing the section related to purchasing and consumption of fresh-cut products, from figure 5 it is possible to see how change the percentage of consumers who declared to purchase fresh-cut fruit and vegetable for the different countries. Should be noted that all interviewed consumers declared that fruit and vegetable belong to them bundle of food.

Figure 5. Percentage of consumers who buy fresh-cut products
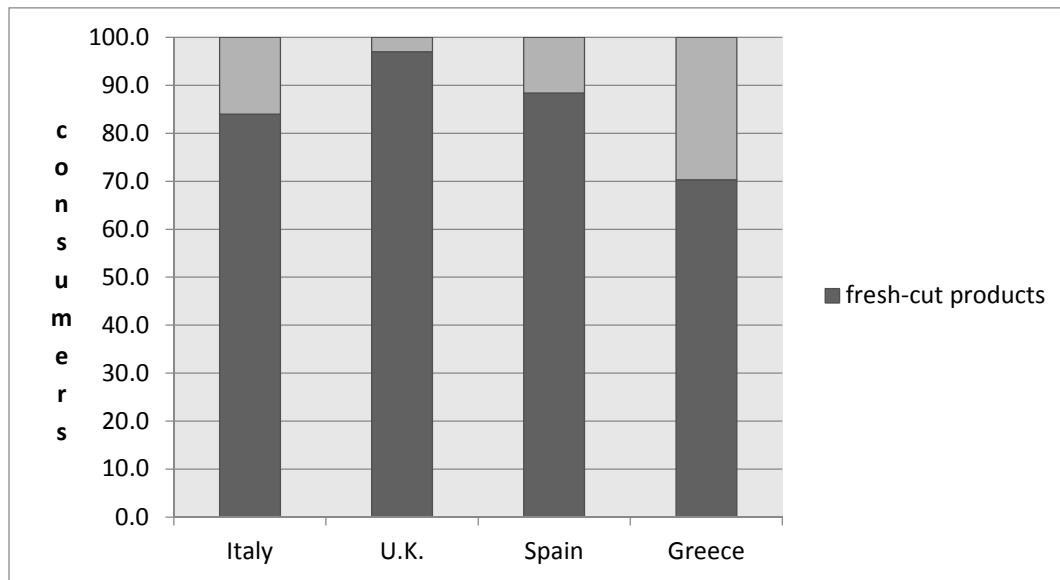
From the graph, it is clear that in the U.K. almost all consumers (97%) buy and consume the ready-to-eat products, followed by Spain and Italy with respectively 88.4% and 84%, while in Greece only 70% of interviewed sample declared to purchase fresh-cut products. These data give information only on the percentage of consumers who purchase fruit and vegetable ready-to-eat, and not on the quantity purchased.

The days in a week that consumers go grocery shopping for the family, with the corresponding household food spending show slight differences. Spanish and Italian consumers declared to go grocery shopping on average almost 3 times a week, with a little difference in total amount spent. Spanish state that they spend about 90.0 euro per week while Italian compared to Italian that spend a little more of 81.0 euro. British and Greek consumers go grocery shopping in average about two times in a week, spending respectively about 73.0 euro and 96.0 euro in a week for food expenditure.

Starting from the data of consume of each interviewed consumer for the different category of food (fruit, vegetables, red meat, white meat, pasta, fish, cheese and dairy product, sweets) has been possible divide the consumer in six different styles of food diet. The different styles of food diet are specified below:

- Mediterranean diet: a regular and balanced consumption of all categories of food;
- Proteic diet: based on a regular consumption of fruit, vegetables, red meat, white meat and fish (at least two times per week), reducing the consumption of pasta, cheese, dairy products and sweets;
- No meat: based mainly on a regular consumption of all categories of food, except for the red meat and white meat (less than one times per week, but at least one time per month, or never)
- No pasta: based mainly on a regular consumption of all categories of food, except for the pasta (less than one times per week, but at least one time per month, or never);
- No sweets: based mainly on a regular consumption of all categories of food, except for the sweets (less than one times per week, but at least one time per month, or never);
- Other: this style contains all different combinations of food diet, which do not follow criteria.
- The frequency of consumers for each food style is reported in the following table 4.

Table 4. Frequency in percentage of consumers for different food style

	Mediterranean diet	Proteic diet	No meat diet	No pasta diet	No sweets diet	Other diet
ITALY	48.9	1.4	7.1	2.2	11.3	29.1
U.K.	28.80	13.30	12.50	18.50	10.90	16.0
SPAIN	42.0	9.20	8.80	9.60	14.0	16.4
GREECE	23.80	10.40	5.50	21.30	12.90	26.1

The table 4 points out the differences in the nutritional diet of different countries. Almost 50% of Italian consumers stated that they have a *Mediterranean* diet, with a balanced consume of pasta, fruit and vegetable, meat and fish. Whereas 29% is classified in the category of *other diet*, and it seem not follow a specific diet scheme, only 2% of Italian consumers do not eat pasta, confirming that the Italy in a great producer and at same time a great consumer of pasta. The sample of British consumers turns out classified in 29% of consumers who have a

Mediterranean diet, 13.3% of them have a *proteic* diet mainly based on regular consume of fruit and vegetables, while should be noted that 18.5% stated to not consume pasta and only 16% is classified in the category of *other diet*. Spanish consumers are similar to Italian for high percentage of consumers who have a *Mediterranean* diet (42.0%), but they differ in percentage of *proteic* diet with 9.2% and the *other diet* category that includes only 16.4%. Finally, Greek consumers have food habits similar to British with 23.8% of *Mediterranean* diet, 10.4% of *proteic* diet and 21.3% of *no-pasta* diet. The consumers that have not a precise scheme in the diet, represent 26.1%. Should be noted that the percentage of consumers in the different countries who are careful to not introduce in the nutritional diet the sweets is included between range of 10.9% (U.K.) and 14% (Spain).

For consumers who declared to buy fruit and vegetables ready-to-eat, the purchase in percentage terms of pre-cut products on the total of fruit and vegetable purchase is 37.2% for U.K consumers, 23.1% for Spanish consumers, 16.7% for Greek consumers and 23.7% for Italian ones. This result confirms that in U.K. there is a greater propensity to consume the ready-to-eat products, followed by Italy and Spain. Another important information is the percentage of total fresh-cut products represented by fresh-cut salads: 12.3% (Spain), 8.8% (Greece), 13.9% (U.K.) and 20.6% (Italy).

The interviewers have also declared the frequency of consumption for every single category of ready-to-eat products, which are: pre-cut fruit, pre-cut vegetables and greens, ready-to-cook products, crudités, bagged salads without dressing and bagged salads with dressing. The frequency of purchase is expressed as times of purchasing per week. In the following tables, the frequency for each category of product is reported, in way to define the bundle for ready-to-eat products for each country analyzed.

Table 5. Frequency in percentage of purchases of fresh-cut products In Italy

	Pre-cut fruit	Pre-cut vegetables and greens	Ready-to-cook	crudités	Bagged salads without dressing	Bagged salads with dressing
3 or more times per week	7.6	18.6	20.5	5.9	16.8	5.6
1-2 times per week	33.3	52.8	42.7	37.5	56.8	12.5
less than 1 time per week	17.0	14.2	18.2	21.2	12.0	10.4
less than 1 time per month	12.0	7.6	8.2	13.4	8.5	11.1
never	30.2	6.8	10.4	22.0	5.9	60.4

Table 6. Frequency in percentage of purchases of fresh-cut products in Spain

	Pre-cut fruit	Pre-cut vegetables and greens	Ready-to-cook	cruditès	Bagged salads without dressing	Bagged salads with dressing
3 or more times per week	10.0	14.9	17.2	17.2	16.7	10.0
1-2 times per week	18.1	42.5	38.0	40.3	45.3	16.3
less than 1 time per week	19.5	22.6	27.6	24.4	21.3	15.4
less than 1 time per month	22.6	13.1	10.9	11.3	10.4	14.9
never	29.9	6.8	6.3	6.8	6.3	43.4

Table 7. Frequency in percentage of purchases of fresh-cut products in U.K.

	Pre-cut fruit	Pre-cut vegetables and greens	Ready-to-cook	cruditès	Bagged salads without dressing	Bagged salads with dressing
3 or more times per week	7.0	9.4	11.7	7.2	12.1	4.1
1-2 times per week	26.8	37.0	36.6	24.7	42.1	15.5
less than 1 time per week	20.2	28.0	25.4	25.6	26.6	21.7
less than 1 time per month	20.6	16.8	15.8	23.7	13.5	17.6
never	25.4	8.8	10.6	18.8	5.7	41.1

Table 8. Frequency in percentage of purchases of fresh-cut products in Greece

	Pre-cut fruit	Pre-cut vegetables and greens	Ready-to-cook	cruditès	Bagged salads without dressing	Bagged salads with dressing
3 or more times per week	4.2	7.7	8.5	6.3	7.0	7.0
1-2 times per week	21.1	33.8	40.8	22.5	21.8	10.6
less than 1 time per week	12.7	26.1	34.5	15.5	26.8	21.1
less than 1 time per month	19.7	18.3	9.9	19.0	12.3	12.0
never	42.3	14.1	6.3	36.6	26.1	49.3

Approximately, by reasoning of frequency of purchases, we can say that the bundle of ready-to-eat products for the consumers of the different countries are very similar. Pre-cut vegetable and greens and ready-to-cook, represent the two categories of products which are purchased with the frequency of two times per week by four different consumers. Also the bagged salads without dressing are purchased with the same frequency by Italian, British and Spanish, while not by Greek. Unequivocally, it is clear that the two categories less purchased by all consumers in all four countries are pre-cut fruit and the bagged salads with dressing. Finally, the category of crudités, seems not follow an equal behavior in four countries, since they are purchased enough in Italy and Spain, less in U.K and almost never in Greece.

On the basis of the expenditure in average for fresh-cut fruit and vegetables, has been possible to calculate the indicator percentage of expenditure, both for the fruit and for the vegetables. The average of the both expenditure is very close, and at the same time is very similar for the different countries. In Italy, consumers declared to spend 18.2% of total expenditure for fruit and 18.2% for vegetables and salads; in U.K. consumers declared to spend respectively for fruit and vegetables 23.2% and 23.9%; in Spain the percentage for the two products is 24.5% and 22.7%, while in Greece the two indicators are 22.5% for the fruit and 22.8% for the vegetables.

The different eating habits are connected with the substitute food when consumers do not eat fruit. Table 9 summarizes the percentage of consumer preferences in the substitution of fruit and vegetables.

Table 9. Percentage of substitute food of fruit and vegetables

		ITALY	U.K.	SPAIN	GREECE
FRUIT	Anything	29.3	30.2	35.2	10.9
	Salty foods	13.7	10.1	4.4	7.4
	Sweets/desserts	16.0	31.1	20.0	31.7
	Coffee/liqueur	9.7	13.1	14.8	13.4
	Fruit juices	14.7	15.5	25.6	36.6
	other	16.6			
VEGETABLES	Anything	9.9	34.1	28.4	22.8
	Bread/flatbread	67.3	19.1	8.0	15.3
	Pasta	19.0	22.2	40.0	13.4
	Meat or fish	3.4	13.1	12.0	10.4
	Cheese/dairy prod.	0.4	11.5	11.6	38.1

The 29% of Italian consumers declared to replace fruit and vegetable with anything, while 16.0% prefer to eat sweets or desserts and 14.7% with fruit juices. British consumers prefer to not eat anything when they do not eat fruit (30.2%), while 31.2% eats sweets or desserts as substitutes. Spanish consumers have partially the same behavior of British ones, in fact 35.2% prefers to not eat anything respect to 25.6% that replaced the fruit with fruit juices. Most of Greek consumers prefer to replace the fruit with sweets or dessert (31.7%) and with fruit juices (36.6%). Other differences, not very marked, emerge from the analysis of the substitutes for vegetable and greens. In U.K., consumers replaced them with anything (34.1%), with bread or flatbread (19.1%) and with pasta (22.2%). In Spain, consumers prefer to eat mainly pasta (40%) when they do not eat vegetables or greens, while 28.4% does not eat anything as substitute. Greek consumers, unlike the previous, prefer replace vegetables and greens with cheese and dairy products (38.1%) while 22.8% of them does not eat anything in substitution.

The different quantities in purchase of ready-to-eat products in the four countries are connected with the different purchasing motivations of the consumers, as explained in the table 10. The consumers declared their agreement degree for the following statement:

1- I prefer to eat fresh fruit and vegetables that are not packaged;

2- I prefer to eat ready-to-eat products to save time;

3- I prefer to eat ready-to-eat products to avoid hassle;

4- I prefer ready-to-eat products because of their higher quality.

Table 10. Percentage of agreement degree regarding purchasing motivations

motivation	Strongly disagree	disagree	neutral	agree	Strongly agree	
1	2.8	22.6	22.9	35.6	16.1	ITALY
2	2.8	13.0	23.8	51.2	9.2	
3	6.8	24.3	25.0	34.7	9.2	
4	9.7	37.0	42.2	9.7	1.4	
1	1.6	4.1	31.3	34.4	28.6	U.K.
2	7.0	15.3	35.6	33.3	9.0	
3	8.2	20.6	35.4	28.2	7.6	
4	13.3	25.2	38.0	17.2	6.3	
1	4.5	4.5	13.6	37.1	40.3	SPAIN
2	11.3	16.7	30.3	33.5	8.1	
3	10.4	23.1	34.4	28.0	4.1	
4	10.9	22.6	45.7	16.7	4.1	
1	0.7	0.7	18.3	40.9	39.4	GREECE
2	8.5	23.2	33.4	33.4	3.5	
3	21.8	40.1	17.6	19.0	1.4	
4	19.0	40.1	31.7	9.2	0.0	

Analyzing the results of previous table, we can see that the different consumers have same purchasing motivations in common. According Italian and British consumers, the majority of them are neutral and agree with the statement 1, 2 and 3, while they are neutral and disagree with the last statement. Spanish consumers turn out to be agree and strongly agree about the first statement while follow the previous behavior of Italian and Spanish for the other statements. Finally, Greek consumers declare to have an agreement degree different from other consumers, in fact they are agree and strongly agree for the first statement, neutral and agree for the second one, while they are strongly disagree and disagree about the third and fourth statement.

Also the attributes of the ready-to-eat products are evaluated in a different way by the consumers. Attributes are important in the choice and in the purchase of products, but it is interesting to observe the different importance that consumer attach to several attributes. The scale of importance is made up of five values, increasing from value 1 to value 5. The

importance for each attribute of ready-to-eat products declared by consumers is reported in the table 11.

Table 11. Percentage of importance for attributes of ready-to-eat

	attributes	colour	brand	own origin	local production	organic production	ease in consumption	price	expiry date	environmental certification	ethical certification
ITALY	Not all important	0.0	9.7	1.4	3.8	8.0	4.2	0.5	0.7	5.2	6.4
	Not very important	5.0	15.8	3.3	10.8	13.2	10.9	6.4	0.9	13.4	16.5
	Quite important	14.1	21.2	14.2	20.5	34.7	26.9	17.2	12.3	31.9	30.7
	Very important	26.2	31.1	38.9	35.6	28.5	29.0	31.1	28.8	26.4	28.5
	Extremely important	54.7	22.2	42.2	29.3	15.6	29.0	44.8	57.3	23.1	17.9
U.K.	Not all important	4.5	17.0	7.2	6.7	17.4	3.5	1.2	2.0	19.0	13.3
	Not very important	13.7	35.0	26.4	25.6	33.5	14.1	3.9	7.8	27.0	28.8
	Quite important	34.5	32.5	33.9	39.9	27.6	42.3	30.9	27.8	31.9	35.0
	Very important	29.9	10.4	19.6	17.6	13.7	28.4	36.6	30.3	13.3	14.7
	Extremely important	17.4	5.1	12.9	10.2	7.8	11.7	27.4	32.1	8.8	8.2
SPAIN	Not all important	3.6	11.3	37.5	4.5	5.0	4.0	3.6	1.8	6.3	7.2
	Not very important	12.7	33.9	39.4	15.9	24.9	14.5	5.0	3.2	8.1	16.8
	Quite important	38.9	38.5	16.7	40.7	40.2	49.8	40.3	31.2	44.4	42.5
	Very important	30.8	13.1	4.1	25.8	21.3	23.1	38.0	36.7	27.6	22.6
	Extremely important	14.0	3.2	2.3	13.1	8.6	8.6	13.1	27.1	13.6	10.9
GREECE	Not all important	0.7	11.3	3.5	2.8	9.9	9.9	0.7	1.4	15.5	20.4
	Not very important	2.8	33.8	7.7	14.1	26.0	25.3	7.7	2.1	20.4	19.0
	Quite important	18.3	32.4	28.9	29.6	35.2	38.7	25.4	21.1	28.2	26.7
	Very important	34.5	18.3	26.8	22.5	16.9	12.0	38.0	23.3	16.9	19.0
	Extremely important	43.7	4.2	33.1	31.0	12.0	14.1	28.2	52.1	19.0	14.8

The color of fresh-cut products are quite important attribute for the majority of British and Spanish consumers, while they are extremely important for Italian and Greek consumers. All consumers give to brand attribute quite importance, with a little difference among Italian consumers who give to it greater importance. The origin of products in own country and the local production are attributes that attract many importance for Italian and Greek, middle importance for British and low importance for Spanish. Averagely, the organic attribute is evaluated as a quite important attribute or not very important attribute by all consumers of four different countries. The same degree of importance is given for the ease in consumption attribute, it is quite important for every consumer with a small difference for Italian consumers that move the importance trough the level of very important and extremely important. The price

is a quite important or very important attribute for British and Spanish consumers, while it seems to be very important and extremely important for Italian and Greek. Also about the expiry date, Italian and Greek consumer give extremely importance to this attribute, while for other consumers the grade of importance falls to level of very important attribute. Finally, environmental certification label and ethical certification label seem to be not very important or quite important for British and Greek, while it seems to be quite important or very important for Italian and Spanish.

Figure 6 gives information about the frequency of purchase of ready-to-use products and foods with a long shelf life. The most part of consumers of the four different countries seem to have a common behavior declaring to buy ready-to-use products sometimes, with a percentage that change in a range of 35% for Italian and 49.5% for Spanish. About the foods with a long shelf life, the majority of British and Greek declares to buy them sometimes with a respective percentage of 43% and 45%, while 41% of Italian and 52% of Spanish declare to buy them often.

Figure 6. frequency of purchasing of ready-to-use products and products with a long shelf life
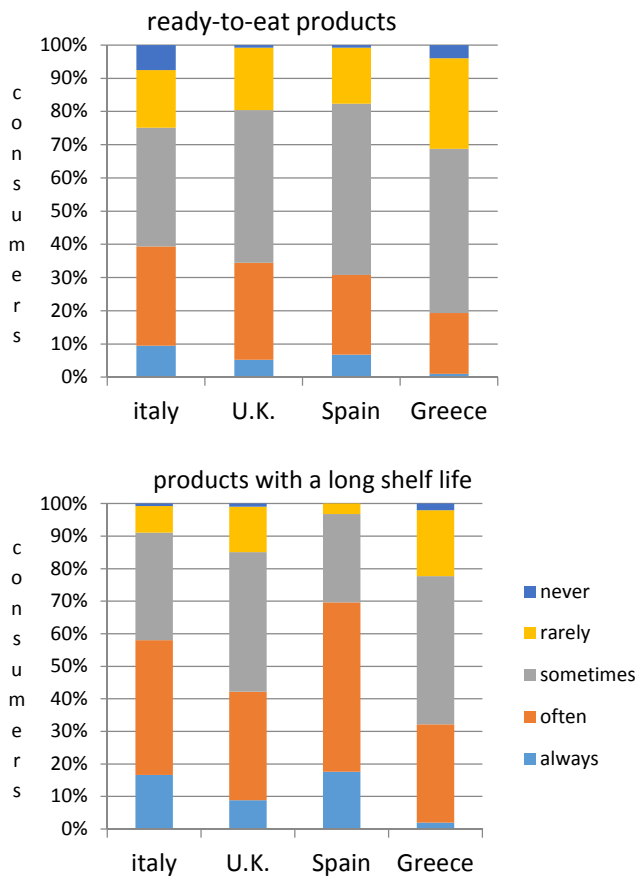

Table 11 gives information about attitude of purchase. Some beliefs can influence the

behavior and the subsequent attitude of consumers, and it can be observed from the declarations of all consumers according to agreement degree at the follow statements:

1- Saving time is important in order to improve the quality of my life;

2- Going shopping less often improves the management of my time;

3- My family and friends believe that ready-to-eat products are of good quality;

4- The views and preferences of my family and friends influence my decision regarding the purchase of ready-to-eat products;

5- My family and friends believe that products with a long shelf life are good quality as much as fresh unpackaged products;

6- The views and preferences of my family and friends influence my decision regarding the purchase of products with long shelf life.

Table 11. Percentage of agree or disagree about statements on the attitude of purchase

ITALY				
statement	strongly disagree	disagree	neutral	agree	strongly agree
1	3.0	11.5	24.9	47.5	13.1
2	2.7	13.5	32.1	41.4	10.3
	absolute false	false	I do not know	true	absolute true
3	3.6	17.0	40.2	34.7	4.5
4	11.9	32.1	22.2	28.5	5.3
5	5.1	25.2	41.6	25.9	2.2
6	10.3	37.8	23.6	25.1	3.2

U.K.				
	strongly disagree	disagree	neutral	agree	strongly agree
1	4.2	16.3	40.7	33.3	5.5
2	2.6	13.7	36.3	40.1	7.3
	absolute false	false	I do not know	true	absolute true
3	2.6	15.7	44.2	33.1	4.4
4	15.7	34.3	20.4	26.6	3.0
5	2.6	22.4	45.6	26.0	3.4
6	15.9	36.1	21.6	22.6	3.8

SPAIN				
	strongly disagree	disagree	neutral	agree	strongly agree
1	2.8	9.2	34.0	46.8	7.2
2	0.8	9.6	34.0	46.4	9.2
	absolute false	false	I do not know	true	absolute true
3	2.0	11.2	40.8	41.2	4.8
4	9.6	35.2	18.0	33.6	3.6
5	3.6	17.2	39.6	35.6	4.0
6	10.4	30.8	20.4	35.2	3.2

GREECE				
	strongly disagree	disagree	neutral	agree	strongly agree
1	1.5	5.4	29.7	50.5	12.9
2	0.5	10.9	45.1	38.1	5.4
	absolute false	false	I do not know	true	absolute true
3	5.9	28.7	42.6	20.8	2.0
4	11.4	49.5	14.3	23.8	1.0
5	10.4	48.5	28.2	12.9	0.0
6	10.9	52.0	14.8	21.8	0.5

CHAPTER 6

THE CHOICE EXPERIMENT MODEL: THE CASE OF FRESH-CUT FRUIT AND VEGETABLES

6.1 Introduction

In line with the definition given by the International Fresh-Cut Produce Association (IFPA), fresh-cut fruit and vegetables (F&V) are products minimally processed, more precisely, only washed, cut, mixed and packed. Since their origin in Europe in the early 1980's, they have become more and more common in consumers' market basket.

Benefits of fruit and vegetables (F&V) on the food diet are nowadays well known and documented in the literature. According to the World Health Organization (WHO), the average daily recommended intake of F&V is more than 400 grams per capita (WHO, 2008). The last *Consumption Monitor* of European Fresh Produce Association (2012) shows that overall, 2011 experienced a slight 2.6% raise in the consumption pattern to 382 g/capita/day for fresh fruits and vegetables on average for the EU-27 (Freshfel, 2013). In order to increase the daily intake of F&V, the "fresh-cut" sector plays an important role, and may help meet the objective of consuming the recommended daily intake of vitamins, minerals and fiber, due to fresh-cut F&V convenience and freshness. In fact, given the great concern about contemporary dietary habits, governments in several countries have lunched informational and educational initiatives aimed at increasing public awareness towards the benefits of F&V, though the effectiveness of this campaign is still debated by several authors (Seiders e Petty, 2004; Gordon et at., 2006; Mazzocchi et al., 2009).

The fresh-cut sector is constantly evolving and innovating in order to enhance quality and safety of products, which attributes are generally valued by consumers. Quality and safety are multifaceted attributes because they arise from a wide set of methods/technologies, therefore the knowledge about consumers' preferences for food technologies is still matter of debate. Microbiology, chemistry, and food engineering researchers are working on providing new solutions in order to enhance quality and safety attributes. Are technological solutions and innovations, however, always accepted by consumers? This is one of the questions this research addresses.

This research is part of QUAFETY[2] EU (Quality and Safety of Ready to Eat Fresh Products), a project co-funded by the European Commission and 6 SME (small and medium size enterprises) that comprises a multidisciplinary group of researchers working on improving fresh-cut products from technical perspectives, combined with economists evaluating consumers' response to the new technologies. The goal of the present research is to provide an

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analysis of consumers' preferences towards novel attributes of fresh-cut F&V by working closely with engineers, chemists and microbiologists, in order to provide industry the best innovation path for processing fresh-cut F&V based on demand information.

Specifically, our objectives are:

d) Testing the impact of segmentation variables already defined by the literature on choice of fresh-cut F&V compared to fresh ones;

e) Assessing consumers' perceptions about the attributes developed through QUAFETY research including shelf life, typology, stabilization processes, and safety indicators.

f) Estimating the willingness to pay for each attribute analysed;

The analysis is based on a European Union (EU) wide and *ad hoc* survey conducted within during the QUAFETY project, in which about 1500 Italian, Spanish, Greek and British consumers were interviewed. Therefore, our final objective is:

g) To conduct a cross-country comparison of consumers' preferences in order to target country-specific innovation paths for processing fresh-cut F&V.

6.2 Fresh-cut consumers' attitude and perception

The research for the fresh-cut F&V quality improvement, from the safety and packaging standpoints, is constantly evolving (Watada et al., 1999; Soliva-Fortuny et al., 2002; Rico et al., 2007; Artés et al., 2009; Amodio et al., 2011). Food science research on technological developments for fresh-cut F&V opens the following question: what is consumers' perception towards quality and safety of fresh-cut F&V products?

While the literature provides a great number of studies about consumers' preferences for the quality of fresh F&V, it remains limited when it comes to minimally processed and packaged F&V. In particular, Pollard et al. (2002) completed a review that provides a rigorous investigation on the factors that affect the choice of F&V and their intake. Sensorial appeal, social interactions, costs, time constraint, personal ideology and advertising are all factors capable of influencing the choice of F&V. Several studies consisting of specific case studies for different types of F&V are also available (Loureiro et al, 2001; Harker et al. 2003; Campbell et al. 2004; Haghiri①a et al, 2009).

The literature on ready-to-use products, which includes the fresh-cut sector, provides different results according to specific attributes considered. First, it is appropriate to mention that previous studies have highlighted the existence of an inverse relationship between the family income and the consumption of F&V (Marshall et al, 1994; Cassady et al., 2007), which

represents a first possible barrier for the some potential consumers of minimally processed products. Consumers to whom this first barrier does not apply, may encounter further barriers such as consumer's social environment, working time, time outside home, consumption of food in restaurant (Frewer et al. 2001; Buckley et al., 2007).

In particular, the strong relationship between the choice of food and its convenience is evident in the literature. De Boer et al., in 2004, analyzed Irish convenience food consumers through a comparison of the regression results across four convenience food categories. They found that in the category with the highest level of consumption, the frequency of purchase is positively correlated with lifestyle (social events, eating alone, breakdown of mealtimes, novelty) and time pressure, while in a negative way with interest in cooking and importance of freshness. Number of children, full-time employment and disposable income are all variables directly connected with perceived time budget and attitude to convenience products (Scholderer et al., 2005). The strongest drivers for convenience food consumption are age, concern about naturalness, nutrition knowledge, and cooking skills (Brunner T.A. et al., 2010).

The increasing interest for food labeling and consumers' positive attitude towards informational facts is confirmed by literature. Labeling and product information (nutritional, safety and technology) appear to be important attribute for consumers (Delizia et al., 2003). Cardello et al. (2007) studied consumers' perception risks associated with innovative and emerging food preservation technology, finding that "innovative technologies" often are associated with unknown heath risk, while the term "cold preservation" yields a positive utility. Interestingly, the attribute "minimally processed" has a negative utility for consumers, which may imply that products that have not been processed sufficiently are perceived as a source of microbiological or other safety risk.

Also the type of packaging seems to influence consumers' choice, in fact label information, the quality of packaging, the brand and the visual impact, are all in descending order, features evaluated by the consumers at the time of purchase (Peters-Texeira and Neela, 2005).

Jaeger and Rose in 2008, through a stated choice experiment, analyzed "eating occasions" attributes with regard of the choice of fresh fruit. First, they found that fresh-cut fruit is less likely to be chosen than fresh one, independently from the price. Second, their research reveals that the main fruit attributes that influence the choice of consumers are time of storage (date of packaging) and the country of origin. In addition, the eating occasions in which fruit is preferred to other food are while driving and while eating in public space. By contrast, fresh-cut fruit is preferred to the fresh one in those occasions in which it is eaten slowly and time is

taken to linger over the food. Also Owen et al. (2002) reported that the choice of fresh fruit and vegetables is often not influenced by the price of an individual item.

Ragaert et al. (2004) analyzed the perception of minimally processed vegetables and packaged fruit, finding that search attributes (product appearance and packaging) are significantly more important in buying stage, while experience attributes (taste, odor, texture) are more important in the consumption phase. Therefore, consumers are not willing to renounce to the high quality, but they want a fair compromise between convenience and quality.

This study adds to the existing literature in that is tests whether new fresh-cut F&V attributes influence consumers' choices and preferences. At the same time, we are able to verify the influence of socio-demographic characteristics on consumers' preferences.

6.3 Discrete Choice Model

Discrete choice models based on the random utility framework are well-established tools in the applied economics literature. In agricultural economics, discrete choice models have been used for several applications, for instance, in the agro-environmental field (Hanley et al., 1998; Campbell et al., 2008; Colombo et al., 2008), in the agri-food marketing (Lusk et al., 2003; Taglioni et al., 2011) and in food safety (Alfens F., 2003; Louriero and Umberger, 2006).

One of the strengths of this methodology is that each good is examined based on its attributes, and each attribute may take different values (or levels). This way, a consumer expresses her preference for each attribute and level (Hanley et al. 2001). Thanks to this feature, stated choice models contributed in the recent years to the improvement of some important aspects of agro-food marketing, like labelling and traceability (Menozzi et al., 2010; Onozaka and McFadden, 2010).

Choice models are based on the theory of consumer developed by Lancaster in 1966 and on the Random Utility Model (RUM). According the theory of consumer, the entire utility in the using of a product could be decomposed in more marginal utilities connected with the various attributes, while according RUM theory, the choice of an individual is connected with the highest utility. Following the RUM framework, we can write the utility function of an individual i, who has to choose across a set of alternatives J, in the time t, as:

$$U_{ijt} = V_{ijt} + e_{ijt}$$

where: U_{ijt} is the utility perceived by the individual;

V_{ijt} is the deterministic component and what a researcher can observe;

e_{ijt} is the stochastic error and unknown to the researcher.

Moreover, the utility observed V_{ijt} is function of the attributes X connected with the choice:

$$V_{ij} = \beta_j \cdot X_{ij}$$

Where X is a vector that represents all the attributes of the alternative j and β is the vector of the coefficients that explain how change the utility V in consequence to a change of a unit in the attribute x.

Assuming that each individual will tend to choose the alternative with greater utility U, in way that $U_{nj} > U_{ng}$ (per each) $g \neq j$, the probability for the same individual i to choose the alternative j is given by (Louriero et al., 2007):

$$P_{ij} = Prob\ (U_{ij} > U_{ig} \cup g \neq j)$$

$$= Prob\ (V_{ij} + e_{ij} > V_{ig} + e_{ig} \cup g \neq j)$$

Where the error terms e are independently and identically distributed (*i.i.d.*) across the several alternatives j.

Discrete choice models can be applied on revealed-preference data or stated-preference data. The difference consists in the context of the choice, in the first situation, data are referred to choice that people make in the real-world situation, while in the second situation, the choice is referred to the intention to choose, which is what the people would choose in a hypothetical situation.

This research is based on stated-preference data and the discrete choice model becomes a stated choice model.

6.4 Data collection and Choice Experiment

For the data collection, a unique questionnaire was administered in the four countries considered for this marketing study: Greece, Italy, Spain and UK. The questionnaire was translated to the national language of each country. Only questionnaires that were completed entirely, 1461 in total, were used for the analyses. Collected observations were distributed among the considered countries as follows: 202 for Greece, 505 for Italy, 250 for Spain and 504 for United Kingdom. Questionnaires were administered through face-to-face interview in supermarkets of big and medium cities, equally distributed in all part of country (in the Greece, all questionnaires have been administered in Athens). The survey was conducted during the biennium 2012-2013. The different countries were treated separately, in order to highlight possible differences existing among them.

The questionnaire is organized in three parts. The first part included questions on consumers' habits, in particular questions about consumption and purchase of both fresh and

fresh-cut F&V. This part included the choice experiment section. The second part included questions related to consumers behavior, in which respondents were asked to express their level of agreement for different statements. The last part of the questionnaire concerned the socio-demographic characteristics of the interviewees.

For the choice experiment section of the questionnaire, consumers were asked to choose among three different F&V products (three alternatives), each defined by five attributes, including price. The experiment included overall a 5 choice-set, were the consumer was asked for five times to choose one alternative among 5 sets of three alternatives. There is no agreement in the literature on how many choice tasks should be presented in a choice experiment (Louviere et al., 2000). We decided that respondents should not face more than five choice tasks given that they might get fatigued and start picking randomly among choices rather than based on their preference (Sattler et al., 2003). Also, we wanted to make sure the assumption that respondents' tastes do not change during the interview was not violated (Sattler et al., 2003). The alternatives proposed in each choice-set, differed among them for the combination and the level of the attributes analyzed. Each respondent was presented the choice sets in a different order, to control for the possibility of order bias.

The product chosen for the experiment is the lettuce. The use of this product is due to the great popularity that lettuce has among consumers (market share of almost 50% - Rabobank International, 2011). In each choice-set there was always a status quo option, represented by the classical fresh lettuce, with an average shelf life of two days and an average price of 1.70 euro per kg. The attributes considered in the experiment are related to the shelf-life, convenience, typology and technology (stabilization process and safety indicators). The shelf-life attribute has been included in the choice experiment to evaluate the perception of consumers about the short or long shelf-life of the products. Besides the status quo, the interviewees could choose between two alternatives of fresh-cut lettuce, respectively with a medium shelf-life (5-7 days) and a long shelf-life (10-12 days). The convenience is mainly measured by adding a dressing to the product already cut and packaged. Then, an attribute referring to the typology, specifically, whether the salad is mixed (lettuce with other greens) or monotype (only lettuce), has been included, as well as attributes regarding the technology, which helps evaluate the degree of acceptability of new technologies and their degree of real confidence. The technologies proposed are the use of inert gases, natural preservatives as stabilization process, or the use of light signal as safety indicator. Given that the product origin has been extensively established to have a relevant weight on consumers' choice in previous

studies (Jaeger and Rose, 2008; Taglioni et al., 2011), we have not included this attribute in our experiment.

The attributes and their levels considered in the experiment are summarized in Table 12.

Table 12. *Choice experiment: attributes and alternatives.*

	Alternatives	
Attributes	Status quo	Proposals
Price	1.70 €/kg	1.92 € x 250 g (7.68 €/kg)
		2.38 € x 250 g (9.52 €/kg)
		2.70 € x 250 g (10.81 €/kg)
		3.06 € x 250 g (12.24 €/kg)
Convenience	fresh	Cut and packed
		Cut and packed with dressing
Shelf life	2 days	5-7 days
		10-12 days
Typology	-	Mixed salad
		Monotype salad
Stabilization process	-	With inert gases
		With natural preservatives
		Not indicated
Safety indicator	-	Light signal
		Not indicated

The choice-sets were presented to interviewees without a numerical order, so to not influence the choice.

Figure 7 shows an example of choice-set presented to the interviewee, which consists of two purchase proposals and the status quo.

Figure 7. *A sample choice set*

PURCHASE PROPOSAL

	Choose one of the following alternatives		
Price	1.70 €/kg	€ 2.70 X 250 g (10.81 €/kg)	€ 2.70 X 250 g (9.52 €/kg)
Packaging	fresh	Cut and packed (without dressing)	Cut and packed (without dressing)
Shelf life	2 days	10-12 days	10-12 days
Stabilization process	-	With natural preservatives	With inert gases
Typology	-	Mixed	Monotype
Safety indicator	-		Light signal
	□	□	□

6.5 Econometric Analysis

Based on the information provided by the survey, a Latent Class Multinomial Logit Model has been fitted for each European country analysed. A latent class is an unobservable subgroup of consumers within the sample, with same preferences and similar behaviour toward the choice. This approach allows us to highlight the presence of different latent classes, and the probability to be part of in each class depends on socio-demographic characteristics (age, income, family), while the choice depends on product attributes (Table 1).

According to the RUM framework, the utility of individual i, who belongs to the class s, derives from the choice of the fresh-cut F&V alternative j:

$$U_{ij/s} = \beta_s \cdot X_{ij} + e_{ij/s}$$

where X_{ij} is the vector of all attributes present in the choice model and associated with the alternative j and the individual i, while β_s represents the specific vector of taste parameters. The coefficient β_s represents the importance and the influence of each attribute for the different classes. The differences in β_s vectors enable to capture the heterogeneity in the attribute preferences among the different classes estimated.

The attributes considered in the model with their levels, codes and interpretation, are reported in Table 13.

Table 13. *Attributes used in the empirical model*

Name	Attribute	Coded using	Level	meaning
PACK	Packaging	categorical	1	Fresh (no packed)
			2	Cut and packed
			3	Cut and packed with dressing
INERT	Stabilization process	dummy	1/0	With/without inert gases
NAT_PR	Stabilization process	dummy	1/0	With/without natural preservatives
SAF_IN	Safety indicator	dummy	1/0	With/without light signal
SHELFL	Shelflife	categorical	1	2 days
			2	5-7 days
			3	10-12 days
TYPE	Typology	categorical	1	Mixed
			2	Monotype
PRICE	Price	continuous		

In the Latent Class Multinomial Logit Model, assuming that the error terms *e* are i.i.d., the probability that the individual *i* in the class *s* chooses the alternative *j*, is given by:

$$P_{ij/s} = \frac{\exp(\beta s\ Xij)}{\sum_{j=1}^{C} \exp(\beta s\ Xij)}$$

In this way, the empirical model becomes:

$$P_{ij/s} = \frac{\exp(\beta pack\ Xij + \beta shelflif\ Xij + \beta type\ Xij + \beta inert\_ga\ Xij + \beta nat\_pres\ Xij + \beta saf\_ind\ Xij + \beta price\ Xij)}{\sum_{j=1}^{C} \exp(\beta pack\ Xij + \beta shelflif\ Xij + \beta type\ Xij + \beta inert\_ga\ Xij + \beta nat\_pres\ Xij + \beta saf\_ind\ Xij + \beta price\ Xij)}$$

Considering *Z* as a vector that specifies all the individual characteristics, which do not vary across the choices, the probability to that the individual *i* belongs to the latent class *s*, is the given by:

$$P_{is} = \frac{(\gamma s\ Zi)}{\sum_{s=1}^{S}(\gamma s\ Zi)}$$

where *s* is the latent class, with s ∈ S, and *γ* is the class-specific parameter estimated for the socio-demographic characteristics Z. In our empirical model the individual characteristics

included are age (AGE), annual family income (INCOM) and the number of family members (FAMIL)[3].

The coefficient γ_{si} enables to capture the influence, positive or negative, of the individual characteristics, to determine the belonging to the different latent classes s. The value of P_{is} is included between 0 and 1, and the sum of all P_{is} is equal to one.

The number of latent class for each country is chosen based on Akaike Information Criterion (AIC) value, with the lowest AIC value corresponding to the optimal number of latent classes.

The same analysis is conducted for each of the four countries. This approach allows us to identify the variables that influence the choice and the belonging to the different latent classes, and to compare these variables across the different countries analyzed.

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[3] AGE and FAMIL are continuous variables. INCOM is a categorical variables referred to annual family income with 8 levels, as reported in Table 3.

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CHAPTER 7

RESULTS

7.1 Statistical description

In this section, the main descriptive statistic variables of the surveyed sample are presented. Given the different sample size in each country, we treat the considered variables in percentage terms. A brief summary statistics of the socio-demographic characteristics of the samples is shown in Table 14.

With regard to the percentage of purchases of fresh-cut F&V, the result of the sample seems to confirm the report of FAO in 2010, in which the United Kingdom confirms to be a great consumer of fresh-cut, with the 97% of interviewees that buy and consume fresh-cut, followed by Spain (88.4%), Italy (84%) and Greece (70.3%). Table 15 illustrates information about grocery shopping habits and the total household food expenditure. Specifically, Spanish and Italian declared to go grocery shopping almost three times per week, spending respectively about 90.0 and 81.0 Euros per week, respectively. British and Greek declared instead to go to grocery shopping two times per week, with a total spending for food of 73.0 and 96.0 Euros, respectively.

In addition to the frequency of purchase, interviewees are also asked about the percentage of fresh-cut products purchased. Also in this case, the different attitude of the countries toward the consumptions of these products is confirmed. The average value of fresh-cut on the total of F&V purchased, is 37.2% for U.K consumers, 23.7% for Italian, 23.1% for Spanish and 16.7% for Greek consumers. Another important information about the consumption is the percentage of total fresh-cut products represented by green salads: 52.7% in Greece, 87.0% in Italy, 53.2% in Spain and 36.7% in U.K. Green salads symbolized the fresh-cut sector, embodying about 50% of total consumption, with the exception of Italy where it represents almost the totality of the consumptions.

As reported in table 16, the respondents have also declared the frequency of consumption for every single category of ready-to-eat products, divided in: pre-cut fruit, pre-cut vegetables, ready-to-cook products, crudités, bagged salads (lettuce or radicchio) without dressing and bagged salads (lettuce or radicchio) with dressing. The frequency of purchase is expressed as the time of purchasing per week. By associating the frequency of purchasing to the consumption of the same products, it could be possible to define the bundle for fresh-cut F&V for each country analyzed. In broad terms, the scenario represented by the table is very close to what stated in the report Rabobank (2010). Pre-cut vegetables and ready-to-cook ones, represent the two categories of products that are purchased with the frequency of two times per week by four different consumers. Also the bagged salads without dressing are purchased with

the same frequency by Italian, British and Spanish, while not by Greek. Unequivocally, the two categories less purchased by all consumers in all four countries are pre-cut fruit and the bagged salads with dressing.

Table 14. *Main socio-demographic characteristics (percentage of consumers interviewed)*

characteristic	group	Greece	Italy	Spain	U.K.
Gender	male	49.0	31.7	47.2	47.1
	female	51.0	68.3	52.8	52.9
Age	18-30 years	27.2	23.8	22.0	21.4
	31-40 years	22.3	22.8	25.2	17.3
	41-50 years	22.3	14.7	22.8	20.4
	51-60 years	19.3	19.0	18.4	21.0
	>60 years	8.9	19.8	11.6	19.8
Education	Primary	0.5	4.5	3.6	1.6
	Secondary	4.0	18.2	13.2	26.8
	Advanced	24.2	25.5	32.4	27.8
	Degree	18.3	18.9	29.2	29.9
	Master	32.7	9.1	14.0	10.3
	Postgraduate	20.3	2.8	7.6	3.6
Annual Family Income	< € 12.000	16.4	18.3	18.8	18.6
	€ 12.001 – € 20.000	22.8	27.7	18.3	29.9
	€ 20.001 – € 30.000	28.0	25.7	20.2	26.7
	€ 30.001 – € 40.000	18.0	14.9	15.9	18.8
	€ 40.001 – € 50.000	7.6	5.4	10.7	4.2
	€ 50.001 – € 70.000	6.4	4.0	10.5	1.2
	€ 70.001 – € 100.000	0.4	2.5	3.8	0.6
	> € 100.000	0.4	1.5	1.8	0.0
Family	1 member	7.4	19.2	8.0	19.2
	2 members	24.3	25.1	29.2	33.1
	3 members	2.8	20.8	28.4	17.7
	4 members	35.6	29.1	23.6	20.0
	>4 members	11.9	5.7	10.8	9.9

Table 15. *Frequency of F&V consumption*

frequency consumption F&V	Greece		Italy		U. K.		Spain	
	fruit	veget.	fruit	veget.	fruit	veget.	fruit	veget.
3 or more times per week	67.7	74.1	79.2	72.5	63.9	75.6	82.0	70.4
1-2 times per week	26.4	21.9	19.0	22.1	24.2	20.0	15.2	25.2
less than 1 per week	5.0	3.0	1.4	5.0	7.7	3.2	2.8	3.2
less than 1 per month	0.0	0.5	0.4	0.4	2.6	1.0	0.0	1.2
never	0.5	0.5	0.0	0.0	1.6	0.2	0.0	0.0

Table 16. *Frequency in percentage of purchases of fresh-cut F&V*

	frequency	Fruit	vegetables	Ready-to-cook	Crudité	Salads with no dressing	Salads with dressing
GREECE	≥ 3 times per week	4.2	7.7	8.5	6.3	7.0	7.0
	1-2 times per week	21.1	33.8	40.8	22.5	21.8	10.6
	≤ 1 time per week	12.7	26.1	34.5	15.5	26.8	21.1
	≤ 1 time per month	19.7	18.3	9.9	19.0	12.3	12.0
	never	42.3	14.1	6.3	36.6	26.1	49.3
ITALY	≥ 3 times per week	7.6	18.6	20.5	5.9	16.8	5.6
	1-2 times per week	33.3	52.8	42.7	37.5	56.8	12.5
	≤ 1 time per week	17.0	14.2	18.2	21.2	12.0	10.4
	≤ 1 time per month	12.0	7.6	8.2	13.4	8.5	11.1
	never	30.2	6.8	10.4	22.0	5.9	60.4
SPAIN	≥ 3 times per week	10.0	14.9	17.2	17.2	16.7	10.0
	1-2 times per week	18.1	42.5	38.0	40.3	45.3	16.3
	≤ 1 time per week	19.5	22.6	27.6	24.4	21.3	15.4
	≤ 1 time per month	22.6	13.1	10.9	11.3	10.4	14.9
	never	29.9	6.8	6.3	6.8	6.3	43.4
U.K.	≥ 3 times per week	7.0	9.4	11.7	7.2	12.1	4.1
	1-2 times per week	26.8	37.0	36.6	24.7	42.1	15.5
	≤ 1 time per week	20.2	28.0	25.4	25.6	26.6	21.7
	≤ 1 time per month	20.6	16.8	15.8	23.7	13.5	17.6
	never	25.4	8.8	10.6	18.8	5.7	41.1

7.2 Latent Class Multinomial Logit Model estimates

The empirical model has been applied to the four countries dataset, and the results are entirely reported in Table 17.

The number of latent class has been chosen based on the AIC information, in which the lowest value represents the optimal number of latent classes. According this criterion, we have two classes for all four countries: Greece, Italy, Spain and U.K..

By examining Table 17 we observe that the majority of the coefficients in the first latent class are negative, while they are positive in the second latent class. This enables to divide consumers in two classes, the ones who do not appreciate the fresh-cut F&V attributes and the ones who appreciate them. Before highlighting the differences among each country, let us notice the common perception of all consumers towards the attribute shelf-life. For the consumers belonging to the first latent class, all fresh-cut F&V attributes have a negative utility in the choice, except for the shelf-life. Results for the second class of consumers yield a different interpretation: for the most part attributes have a positive coefficient, while the shelf-life coefficients have a negative sign, corresponding to a negative utility in the choice, even if not statistically significant for all the countries.

Concerning the interpretations of the coefficients, it is appropriate to recall that the variables PACK and SHELF are categorical variables with three different values as previously reported in Table 13. PRICE is a continuous variable, while INERT, NAT_PR and TYPE are dummy variables.

About Greece, we can divide the Greek sample consumers in two latent classes. For the first class, the utility coefficients reveals that the most important attributes considered in the choice of fresh-cut F&V are the packaging, the stabilization with inert gases and safety indicators. Given that all the coefficients are negative, they prefer fresh F&V to fresh-cut ones. However, at the same time they want a product with a longer shelf-life. About the socio-demographic characteristics, only income seems to determine the belonging to the different classes, where consumers with a high income have less probabilities to belong at the first latent class, that are those who prefer the fresh F&V.

Also Italian consumers could be divided in two latent classes. The first one is represented by consumers that do not appreciate any fresh-cut attributes, with the exception of shelf-life. On the other side, the second latent class includes consumers influenced in a positive way by the most part of fresh-cut F&V attributes. In detail, the packaging with the dressing, the mix compositions of the product, the stabilization with natural preservatives, and the presence of

technological safety indicator, have all a positive utility in the consumers' choice. A negative utility is associated with a long shelf-life. For Italian consumers, all three demographic characteristics seem to determine the belonging at two different classes. Older people, or with a lower annual family income, or with more member in the family are more likely to represent the first latent class.

Spanish consumers follow the same behavior of the previous countries presented. They could be divided in two different classes. Those who prefer fresh F&V have a negative utility for packaging, natural preservatives and safety indicator attribute, but they prefer a longer shelf-life. For the consumers included in the second class, the packaging is the most important attribute in their choice: they prefer the product cut-packaged with dressing to the product simply cut and packaged. The socio-demographic characteristics do not determine the belonging to the two different classes.

In U.K., the separation of consumers in two classes seems to be more pronounced, given the statistical significance of each attribute in both classes, except for the inert gases attribute. The first class, represented by fresh F&V consumers have a negative utility by all the fresh-cut attributes. They follow the same behavior as the other countries' consumers belonging to the first latent class, as they prefer fresh products with a longer shelf-life. For the second class that appreciates the fresh-cut F&V, the most important attribute in the choice of F&V are the packaging (cut-packaged with dressing products are preferred to cut-packaged products), the stabilization with natural preservatives and the presence of light signal as safety indicator. Also in this case, the shelf-life has a negative utility in their choice. The age of consumers seems to determine the belonging to two classes, but unlike Italian consumers, younger consumers have less probability to be in the first latent class.

Table 17. *Latent Class Multinomial Logit Model estimates for fresh-cut F&V attributes*

	GREECE	ITALY	SPAIN	UK
AIC	1.285	1.764	1.611	1.471
Class 1 Probability	.632	.518	.471	.520
Class 2 Probability	.368	.482	.529	.480
variable	Coefficient	Coefficient	Coefficient	Coefficient

Utility parameters in latent class -->> 1				
PACK |1|	-3.041 (.833)***	-2.454 (.485)***	-5.218 (1.479)***	-2.933 (.499)***
INERT_ |1|	1.478 (.607)**	-.911 (.471)*	1.292 (1.120)	.685 (.425)
NAT_PR|1|	-33.855 (860)	-3.770 (.873)***	-3.301 (1.989)*	-6.427 (1.573)***
SAF_IN |1|	-3.438 (1.277)***	-1.784 (.383)***	-4.542 (1.377)***	-3.791 (.766)***
SHELFL|1|	4.270 (1.579)***	2.217 (.587)***	6.151 (1.954)***	4.702 (1.002)***
TYPE |1|	-2.294 (1.769)	-.366 (.345)	-.292 (1.234)	-3.218 (.888)***
PRICE |1|	-1.676 (3.012)	-.795 (.571)	-5.824 (3.469)*	-.155 (1.152)

Utility parameters in latent class -->> 2				
PACK |2|	.187 (.153)	.677 (.094)***	.341 (.118)***	.811 (.085)***
INERT_|2|	.238 (.162)	-.076 (.098)	.026 (.126)	.001 (.096)
NAT_PR|2|	-.031 (.736)	1.651 (.440)***	.648 (.535)	1.066 (.414)**
SAF_IN|2|	.093 (.308)	1.015 (.176)***	.147 (.223)	.478 (.167)***
SHELFL|2|	.071 (.355)	-1.034 (.212)***	-.045 (.257)	-.562 (.199)***
TYPE |2|	-.135 (.367)	.699 (.223)***	-.135 (.275)	.355 (.214)*
PRICE |2|	-.219 (.466)	-.571 (.283)**	-.472 (.347)	-.783 (.268)***

This is THETA(1) in class probability model				
Constant|	2.570 (1.154)**	-.734 (.460)	.716 (.790)	1.963 (.471)***
FAMIL |1|	-.199 (.136)	.212 (.091)**	-.173 (.111)	-.123 (.075)
AGE |1|	-.010 (.013)	.021 (.006)***	-.008 (.010)	-.022 (.006)***
INCOM |1|	-.216 (.104)**	-.278 (.091)***	.097 (.095)	-.002 (.054)

Notes: Number total of respondents are: 202, Greece; 451, Italy; 250, Spain; 504, U.K.. (the Italian sample size has been reduced by excluding 54 observations, corresponding to the respondents who did not participate in the choice experiment, out of the 505 total observations)
Log Likelihood = -630, Greece; -1319, Italy; -988, Spain; -1835, U.K..
Pseudo R^2 = 0.43, Greece; 0.47, Italy; 0.28, Spain; 0.34, U.K..
Number in parenthesis are standard errors.
* Significant at the 10% level.
** Significant at the 5% level.
*** Significant at the 1% level.

7.3 Willingness to pay estimates

While the table 17 shows the utility attributes in the choice for the two different latent classes, in table 18 are reported the marginal value for each attribute through the willingness to pay (WTP).

The WTP can be derived directly from the ratio WTP = - $\frac{\beta k}{\beta y}$, where β_k represents the marginal utility coefficients (β coefficients in the table 17) and β_y is the marginal utility of price. A positive WTP means that a consumer is willing to pay a premium, while a negative WTP corresponds a willingness to pay a discount by consumers.

The direct interpretation of the WTP is the percentage change in the consumers' willing to pay a premium or a discount per each attribute considered in the choice. The WTP has been estimated for both classes.

Considering only the coefficient sign, positive or negative, we can see the impact of each fresh-cut F&V attribute on the consumers' WTP. It should be noted that the sign of WTP coefficients are the same for the marginal utility coefficients, previously shown in the table 17.

The WTP estimation is important to observe the heterogeneity of preferences across the different consumers, and across the different countries. These results do not enable to have a total overview on the WTP for both classes in all four countries because of the restricted statistical significance. Concerning the first latent class in Spain, consumers are willing to pay a premium only for the shelf-life, while their WTP is negative for the attribute of packaging (they are not willing to pay for the convenience offered by packaging), stabilization process with natural preservatives and presence of safety indicator. On the other side, the second latent class referred to Italian and English consumers, has a positive WTP for the packaging, the stabilization process with natural preservatives and the signal light. From the results, they are not willing to pay a premium to have a longer shelf-life.

Table 18. *WTP estimation for fresh-cut F&V attributes*

	attribute	GREECE	ITALY	SPAIN	U.K.
Class 1	Packaging	-1.81	-3.09	-0.90*	-18.92
	Inert gases	0.88	-1.15	0.22	4.42
	Natural preservatives	-20.20	-4.74	-0.57*	-41.46
	Safety indicator	-2.05	-2.24	-0.78*	-24.46
	Shelf-life	2.55	2.78	1.06*	30.34
	Type	-1.37	-0.46	-0.05	-20.76
Class 2	Packaging	0.85	1.19*	0.72	1.03*
	Inert gases	1.09	-0.13	0.06	0.01
	Natural preservatives	-1.42	2.89*	1.37	1.36*
	Safety indicator	0.42	1.78*	0.31	0.61*
	Shelf-life	0.32	-1.81*	-0.10	-0.72*
	Type	-6.16	1.22*	-0.29	0.45*

* Significant at least at the 10% level.

We can say that the WTP coefficients estimated are statistically significant at least at 10% level, in that it is a ratio between two coefficients already statistically significant at least at 10% level, as reported in the previous table 6.

CHAPTER 8

CONCLUSIONS

Conclusions

A similar behavior of fresh-cut F&V consumers for the four European countries, Greece, Italy, Spain and U.K., becomes apparent with the Latent Class Multinomial Logit Model. In broad terms, we can divide the consumers in two different latent classes. The first includes consumers that do not appreciate any fresh-cut F&V attributes and thus they prefer to choose and consume fresh F&V. Consumers that appreciate the several fresh-cut F&V attributes, even if in different measures across different countries, define the second class.

From our findings, consumers that belong to the first class obtain a negative utility for the majority of the fresh-cut attributes. For this reason, they seem willing to reject the convenience offered by fresh-cut F&V. The sole attribute that is more important to their choice, is the shelf-life of the products, preferring F&V with 5-7 shelf-life days to those with 1-2 shelf-life days, and conversely F&V with 10-12 shelf-life days to those with 5-7 shelf-life days. From this information, we could conclude that this category of consumers, purchasing fresh lettuce, do not value the convenience of the products, but they only care about the possibility of storage life.

We have different interpretations for the second latent class of consumers. First, they seem to appreciate fresh-cut F&V, even if they follow a priority scale in their choice. The packaging is one of the most important attribute appreciated, fresh-cut lettuce already packaged and with dressing has more utility compared to the simple packaged fresh-cut product. They also appreciate the new technology present in the packaging, like the presence of a light signal that indicates the freshness and the safety of the products. Moreover, they prefer the stabilization with natural preservatives to the inert gases process. An important result is represented by the negative utility associated with a long shelf-life. In this way, we can conclude that these consumers are more willing to buy fresh-cut products, mainly for the convenience that they offer, renouncing at the same time to a long shelf-life, hypothesizing that they buy and consume them in few days, without the need to store them for several days.

Consumers' socio-demographic characteristics determine the belonging at the different latent classes. In line with the results of Marshall et al. (1994), Cassady et al. (2007) and Buckley et al. (2007), we can confirm that family income influences fresh-cut F&V consumers' preferences. People with a low family income have a higher probability to belong to the class that prefers fresh products to fresh-cut F&V. Notice that this effect is less marked compared to previous studies, consistent with the increasing purchasing trend for these products, as reported by Rabobank (2011). In addition, consumers' age is an important variable in the choice of

fresh-cut products, as suggested by Brunner et al. (2010). In this research, the variable "age" seems to be relevant for Italian and English consumers, with the difference that older Italian consumers are more likely to fall in the first class, as opposed to the U.K. consumers, who fall into the second class.

As previously shown by Scholderer et al. (2005), the family size and the number of children are determinant factors in the choice of convenience products. With our findings, we can confirm this result only for the Italian consumers.

In conclusion, packaging, consisting of F&V already cut and packed with the dressing, stabilization process with natural preservatives, and the use of light signal as safety indicator, are the most important factors considered by consumers when choosing fresh-cut F&V, at least in the case of lettuce purchase and consumption. This is informative for the technological sector, which is constantly committed to the improvement of these products.

The cross-country comparison of consumers' preferences has not produced substantial differences across the different countries. These findings enrich the general overview about the fresh-cut F&V market, providing useful information to all companies operating in this sector. They could produce similar products to export and sell in the different countries, with the awareness that the consumers will appreciate them.

Finally, our results have the potential to be improved and enriched by adding further information, such as the consumers' perception about the quality and the convenience, or the consumers' habits to verify a connection with their lifestyle.

The candidate confirms that the work submitted is his own, except where work which has formed part of jointly-authored publications has been included. The contribution of the candidate and the other authors to this work has been explicitly indicated below. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to the work of others.

- Chapter 3: Italian demand for fresh-cut Fruit and vegetables through Scanner data.
  Cohautors: Baselice a., Stasi A., Diotallevi F., Marchini A., Nardone G.

- Chapter 6: The Choice Experiment Model: The Case of Fresh-cut Fruit and Vegetables
  Cohautors: Baselice, A., Colantuoni, F., Lass, D. A., Gianluca, N., & Stasi, A