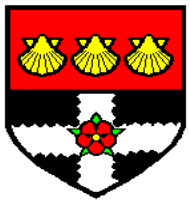

The University of Reading

Econometric Analysis of British Consumers' Willingness to Pay for Syrian Organic Olive Oil

Thesis Submitted for the Degree of Doctor of Philosophy

Department of Agricultural and Food Economics

School of Agriculture, Policy and Development

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October 2016

Declaration

I confirm that this is my own work and the use of all material from other sources has been properly and full acknowledged.

( )

Razan Adnan Majar

October 2016

This thesis was written with lots of pain and sadness moments to what happened in *Syria*.

It is a promise to build *Syria* again

Razan Majar

2016

Abstract

In Syria, as in other Mediterranean countries, olive tree cultivation occupies the number one place among fruit trees. Syrian olive oil has the comparative advantage for this product, this gives the opportunity to export the olive oil to the UK market. Recently, the worldwide demand for organic olive oil has expanded rapidly and has acquired a larger share of the market, especially in regard to issues relating to personal health, food safety concerns, and food quality. The study investigated the preferences of British consumers towards organic olive oil in general and Syrian organic olive oil in particular. For this purpose, two qualitative methods which include focus group discussion and verbal protocol analysis have been conducted. In addition, data was collected through an online survey from British respondents in the UK. The stated preference technique is used for a series of hypothetical scenarios presented in Choice Experiment. Consumers were asked to make trade-offs between changes in the levels of a range of attributes. Discrete choice model based on random utility theory helped to evaluate willingness of pay a price premium for organic olive oil and other attributes of product. Mixed Logit, Probit and Ordered Probit Models were employed to analyze CE outcomes using the Bayesian econometrics approach. Three model specifications of the standard mixed logit model were included in terms of scale heterogeneity of variance, attribute non-attendance and importance ranking of attribute. This study sheds the light on the constraints and the opportunities for Syrian organic olive oil in relation to domestic and international markets, with particular focus on the export potential to the UK. It was found that Syrian olive oil faces intensive competition from European companies that have a high reputation for the excellent quality of their olive oil. Syrian olive oil is a new product that has been introduced recently in the international market. It, therefore, requires substantial marketing and promotional support to garner consumer acceptance. Syrian farmers were inexperienced in using advanced olive oil extraction methods. These constraints could reduce the potential for Syrian olive oil exports. This research sheds the light on the potential role of the Syrian government and decision makers to help and encourage Syrian farmers to move to organic methods in olive sector. The study found that both organic (and non-organic) olive and olive oil have been promoted by the Syrian government as a suitable income source for Syrian farmers. Syrian promotion policies have covered into two parts; the first is related to direct promotion policies such as subsidies, loans and grants. The second is related to indirect promotion through foreign organizations and projects in collaboration with the government.

Results revealed that attribute non-attendance is a dominant behaviour in CE. Findings showed that British people prefer organic olive oil in general and they are willing to pay for this attribute in order to be assured of health and safety food products. Consumers were unwilling to pay a price premium for Syrian organic olive oil. Results revealed that some respondents do not recognise that they use price as a cue of quality, or they have adopted some other form of heuristic the nature of which is unclear.

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Acronyms and Abbreviations

AN-A	Attribute Non-Attendance
AF-A	Attribute Fully-Attendance
BC	British Consumer
CBT	Consumer Behaviour Theory
CoO	Country of Origin
CoOL	Country of Origin Labelling
CE	Choice Experiment
DCE	Discrete Choice Experiment
EVOO	Extra Virgin Olive Oil
EU	European Union
FAO	Food and Agriculture Organization
FG	Focus Group
GAFTA	Great Arab Free Trade Area
GCSAR	General Commission for Scientific Agricultural Research
ha	Hectare
ICARDA	International Centre for Agricultural Research in the Dry Areas
IFOAM	International Federation of Organic Agriculture Movement
IIA	Independence of Irrelevant Alternative
IID or *iid*	Independently and Identically Distribution
IOC	International Olive Council
IOOC	International Olive Oil Council
IPM	Integrated Pest Management
IR-A	Importance Ranking-Attribute
MAAR	Minister of Agriculture and Agrarian Reform
MargLL	Marginal Log Likelihoods
ML	Mixed Logit
NAPC	National Agricultural Policy Centre (Syria)
NGOs	Non- Government Organization(s)
t	tonne
pc	Percentage

Pdf.	Probability density function.
PDO	Protected Designation of Origin
PGI	Protected Geographical Indication
RP	Revealed Preference
RCA	Relative Comparative Advantage
RUT	Random Utility Theory
RUM	Random Utility Maximization
SN-A	Stated Non-Attendance
SP	Stated Preference
UK	United Kingdom
UNDP	United Nations Development Programme
US	United States
USDA	United States Department of Agriculture
VPA	Verbal Protocol Analysis
WHO	World Health Organization
WTO	World Trade Organization
WTP	Willingness to Pay

Symbols

e.g.	for example
etc.	and other things
i.e.	That is
&	and
$	Dollar
€	Euro
%	Percent
<	Less than
>	greater than
≤	less than or equal to
≥	greater than or equal to

Chapter One: Introduction

1.1 General Introduction

In recent years, the worldwide demand for organic olive oil has expanded rapidly and has taken a larger share of the market. It was stimulated by consumers who are concerned with issues relating to personal health, food safety and food quality. The largest growth of demand for organic products has occurred in the developed countries, such as United Kingdom, United States, and other countries; which are considered as major importers for some specific products such as organic olive oil.

In developing countries, organic agriculture is considered as a sustainable and environmental friendly production method, where the advantages of this agriculture are mainly for smallholders' farmers. Organic production methods contribute essentially in reducing the poverty, conserving the natural resources (olives trees), obtaining food security and safety and increasing the farmers' incomes. Syria is like any developing country, organic agriculture in terms of organic olive and olive oil has been promoted by the Syrian government as a suitable income source for Syrian farmers. Syrian promotional policies have covered two parts; the first part related to direct promotion policies such as subsidies, loans and grants. The second part of Syrian government policy is related to indirect promotion through foreign organizations and projects in collaboration with the government. In this study, one of the objectives is to examine both the constraints and the opportunities for Syrian olive oil (particularly organic olive oil) in relation to domestic and international markets, with a particular focus on export potential to the UK market. This research will also shed light on the potential role of the Syrian government and Syrian decision makers to help and encourage Syrian farmers to move on to organic method in the olive production sector.

Internationally, olive oil is a versatile product with high production in the countries surrounding the Mediterranean basin (Europe & North Africa) where suitable agronomic and climate factors contribute to the production of high quality of olive and olive oil products. The major players in producing olive and olive oil are Spain, Italy, Greece, Syria, Tunisia, Turkey and Morocco (FAO, 2011). 90% of the world production of the olive fruit is for oil extraction and the remaining 10% for table olive (IOC, 2014). Spain is the main producer of olive oil with 1.78 million tonnes (IOC, 2016) while Syria has occupied the fourth rank internationally in producing olive oil till 2011. After that the production of olive oil is declined due to the conflict (2011 to 2016). The consumption of olive oil also increased recently in the world and the

European Union is now the main consumer of olive oil. The trends for export and import activities showed that the main exporter of olive oil product is Italy with 29.2 % of the world exports.

In Syria, as a Mediterranean country, olive tree cultivation occupies number one place among fruit trees. In the last decade and before the conflict in 2011, the olive crop was considered a strategic crop due to its importance as a secure food source for Syrian people and its valuable addition to national income (SEF, 2016). According to International Olive Council (2016), Syria continue to be one of the major growing producers in the Mediterranean Basin. The cultivated lands of olive trees spread widely and coved 65% of total planted lands of fruit trees in Syria. Production continued to increase in most years till the commencement of the conflict in 2011. Later, there was clearly a significant decline in Syrian olive production which reached the lowest level in the 2014/15 season. The consumption of olives has also fluctuated from year to year due to the conflict. However, the production of organic olive in Syria is till at an early stage. The total number of the organic farms in Syria was 3256, with 28462 hectares (GCSAR, 2007). The sector of organic olive oil has beneficial effects for Syrian people because more than 200,000 families (around one million people) work in the olive and olive oil sector and they depend on the olive farming income. The development in the organic agriculture sector gives the Syrian farmers the opportunities to improve their level of living, increase their incomes and returns and give them a chance to export abroad. Some challenges face the Syrian olive oil farmers in expanding the export activity such as the completiton from European companies (Italian & Spanish) which already have an excellent reputation for their olive oil products. Syrian olive oil is quite a new product in the market, and to export abroad, requires substantial marketing and promotional support to meet the consumers' preferences in the international market. Syrian farmers need more training workshops in order to improve the organic agriculture and to leave the traditional methods of planting and growing olive trees.

In Spite of all these challenges, Syrian olive oil has a comparative advantage for this product compared with other EU olive oil products, and frankly that gives Syria the opportunity to be a major exporter of olive oil products to a non-traditional, emerging market like the UK market. It also stands to benefit from the increasing expansion in the demand for organic olive oil products. Before 2011, in terms of trade policy in Syria, several trade agreements and negotiations were signed by the government in order to remove obstacles for the production and marketing abroad of organic products (Garcia, 2003). In 1995, The Barcelona Process (Euro-Mediterranean partnership) was lunched including Syria; the main goal of this agreement was to create a free trade, "export processing zone". All these agreements help Syrian products

to be exported abroad to international markets. In the current conflict in Syria, all these assessments and regulations relating to the opportunity to export abroad and the challenges facing the Syrian farmers may be not relevant in terms of what has done in this research. However, all trends and analysis are estimated with the hope that Syria will soon be back again in a peaceful and prosperous situation with a stable economy.

A conceptual framework for this research is mentioned in Appendix one, divided into two sides. Firstly, the supply side which represents the possibility of Syrian farmers to produce organic olive oil with the comparative advantage and to export abroad to a non-traditional, emerging market such as UK, and secondly on the demand side, where British consumer' preferences of olive oil have been increasing recently especially for health and safety reasons.

The way to elicit different perspectives of consumers' preferences in term of choosing a product is asking what they prefer to choose under a specific situation in order to get stated preference data. In this research, the stated preference approach allows obtaining data about Syrian organic olive oil product which does not exist in the UK market yet. In fact, it was not available to use a revealed preference in this study because until now there is no actual choice of Syrian organic olive oil in the UK market. Therefore, the stated preference method in the context of choice experiment is quite appropriate and relevant to be used in this study.

Discrete Choice Experiment (DCE) application can mimic the market structure in which consumers opt to make a trade-off between varieties of a product's attributes. Therefore, choice experiment aims to explore consumers' preferences by identifying different attributes of a product and predicting accurately the buying activities by consumers in the marketplace. In this context, a product is identified by different attributes and levels for each attribute, a combination of both the attributes and their levels is called a profile or option or alternative. In the survey of DCE application, respondents are required to choose between the current default option, which is called the status quo, and two other options that represent different levels of product attributes. Therefore, the respondents make a decision and choose one of the most preferred hypothetical option presented in a choice set. All choice sets in its sum constitute the design of choice experiment (Kessels *et al.*, 2009). At this point and dependent upon the consumer preferences, the applied choice experiment is an effective tool to estimate the importance of product attributes and their levels. DCE also allows the estimation of willingness to pay (WTP) a price premium for a marginal change in the levels of other attributes. Data obtained from DCE through an online survey is typically analysed using the Bayesian econometrics methods based on the random utility theory. Probit and ordered probit models and mixed logit model were employed in this study. Three model specifications were included in the standard mixed

logit model to investigate British consumers' preferences and willingness to pay estimation in terms of heterogeneity scale variance, attribute non-attendance and importance raking of attributes.

1.2 Research Objectives

This study's research objectives are:

1. To investigate the preferences of British consumers towards organic olive oil in general and Syrian organic olive oil in particular.

2. To evaluate the willingness of British consumers to pay a price premium for organic olive oil in general and for Syrian organic olive oil in particular; using stated preference methods through the application of discrete choice experiment.

3. To investigate the effect of including heterogeneity scale and stated Attribute Non-Attendance (AN-A) and Importance of Ranking Attributes (IR-A) on willingness to pay in the context of DCE.

4. To investigate whether respondents continue using the price of olive oil as a cue for quality or not in the purchasing process based on the discrete stated choice experiment.

1.3 Key Points from Results

Results from Debriefing Questions

1. It was found that 396 respondents out of 412 reported to have ignored at least one attribute; this indicates that attribute non-attendance is a dominant behaviour in our hypothetical choice experiment.

2. It was found that the preferences of British consumers under four socio-demographic characteristics increased the probability of attendance or non- attendance for some given attributes. For example, older British consumers and high-income people had a high propensity to consume organic olive oil. Their concern increased in terms of having a healthy and safe product. It was also found that British consumers did not prefer Syrian organic olive oil and they revealed their preferences for other olive oil origins.

3. Findings explain how socio-demographic variables influence the probability of giving a specific rank to an attribute, revealed that the preferences of British consumers under four socio-demographic characteristics increased the probability of importance ranking for some attributes. For example, age, income and size of household categories has increased the probability of organic olive oil to be ranked at the top of British consumers preferences. However, men have increased the preferences to the taste of olive oil more than women.

4. The outcomes for both models (AN-A, IR-A) are realistic and consistent. British respondents gave high importance ranking to less ignored attributes.
5. Results revealed that some respondents do not recognise that they use price as a cue of quality, or they have adopted some other form of heuristic the nature of which is unclear.

Results from Mixed Logit Model and Willingness to Pay:

1. The model incorporating attribute non-attendance (AN-A) outperformed models that did not incorporate debriefing data and the model that incorporated rankings. Models that incorporated rankings outperformed models that used no debriefing information.
2. Mixed logit gave consistent parameter results across three specifications. British consumers exhibit strong preferences towards organic olive oil in terms of health and safety food choice. However, British consumers did not prefer Syrian organic olive oil relative to other CoO.
3. British consumers are particularly willing to pay a price premium for having organic olive oil, which is between 29-39 pence more than non-organic olive oil.
4. British consumers are not willing to pay for Syrian olive oil.

This thesis contributes to organic olive oil in general and to Syrian organic olive oil in particular since it is one of the few so far that have provided an insight into the olive oil market and which have gathered information and knowledge with regard to the supply side (Syria) and the demand side (UK) in the market. The study obtains a better understating of British consumer behaviour for the different attributes of olive oil products included in the choice experiment. In addition, investigating the British willingness to pay more for Syrian organic olive oil. This study contributes to investigating a new method whether British consumers use a high price to infer a higher quality or not in terms of stated attribute non-attendance and importance ranking for price attribute. This research has shed light on the most important issues facing Syrian farmers and marketers in their production of high quality olive oil and whether it can compete with other brand names in the Mediterranean basin and find the potential for marketing Syrian olive oil abroad.

Findings from this study offered important information about British consumers' preferences and the potential for marketing Syrian organic olive oil within the UK. There are some policy implications from results and findings:

1. Our findings underpin the idea that organic choice of olive oil is the main driving force for British consumers and it will help consumers in their final decision to pay more for organic labelling existing in the UK rather than that provided by country of origin (Syrian) label. Results

also suggest an increase the British consumers' knowledge about organic olive oil rather than other attributes (CoO), therefore the market strategies should be targeted to increase the consumption of olive oil based on organic aspects more than CoO.

Another marketing strategy which could help the potential for marketing Syrian organic olive oil in Britain is by giving greater symbolic insight into organic food purchasing through the safeguard of traditional Mediterranean products (Idda *et al*., 2008). Both olives and olive oil have a noticeable place in the cultures of the countries in the Mediterranean and it is well known that the Mediterranean diet is healthy, leading to well-being and long life and this idea needs to be promoted more to encourage the use of olive oil products in the UK.

2. The evidence provided by the current study shows that the British people are not willing to pay a price premium for Syrian organic olive oil while they are willing to pay for the country of origin such as Italian or Spanish olive oil. In thinking about price, there are two points to be considered before establishing a price strategy for Syrian organic olive oil, the first point, the current study includes a hypothetical experiment and it is not in a real market, so it is worth to have a plan to have a greater knowledge of what British consumers preferences and needs would be. For this point, the current research was conducted into two qualitative methods (focus group and verbal protocol analysis). The second point is whether the Syrian organic olive oil in a competition with Italian or Spanish brand names or not. The policy implication is that with a totally new product like Syrian organic olive oil, two main strategies are the most common for setting prices in the market; the lowest price for Syrian product compared with Italian or Spanish brand names, this strategy is called "penetration pricing", it is a technique where Syrian organic olive oil can be provided relatively well in the market at a lower initial entry price, and often less than Italian or Spanish olive oil prices, according to that the demand on a Syrian product will increases at the lower prices. The second price strategy is that British olive oil market should establish the highest price for Syrian organic olive oil. The issue of setting high price for Syrian organic olive oil, in the existence of competition, is the reaction of other business companies such as the famous Italian and Spanish companies. They may react immediately by improving their products or may cut the prices instead. However, if there is not much competition, then it is much easier to keep a high price for Syrian organic olive oil. This in its turn will help to gain high profits and returns.

3. According to our results, older people seem to be less WTP for organic, it might be due to the expensive price for organic olive oil rather than the conventional one. This implies that market strategy should encourage marketing companies to target young people in an attempt to create new olive oil habits and focus on some health and safety attributes such as organic. These findings imply that the strategy might be to target older people who are attracted by symbolic

motives to protect traditional Mediterranean products in which Syrian organic olive oil is considered one of those products. This could increase the demand for Syrian organic olive oil in the emerging UK market. A good market strategy is usually focused on providing advertisement for the new product to reach a specific market segment.

4. Results from the empirical current study suggest policy implications and conclusions about British consumers evaluating the quality of olive oil based on the price. Results revealed that respondents who placed their choice and preferences based on price attribute level (£2) are not ignoring the price attribute and give a lower importance ranking in our CE. In food choice context, results indicate that the British consumers did not consider the higher the price the better the quality of product. This finding implies that the price is of course an important attribute for the majority of respondents, as mentioned earlier, so the market strategy should act strategically in terms of providing Syrian organic olive oil in the market at the cheapest price level. This can help consumers based on their behaviour and preferences. There is another price strategy might help in this case, to offer discount for Syrian organic olive oil in the market. This strategy will work effectively if the consumers tried the Syrian organic olive oil product and then repeat buying the product. Results also imply that focusing on making trade-offs between other attributes which also present a good quality of olive oil.

1.4 Thesis Structure

This thesis comprises of seven chapters. A description of the structure of the thesis is shown briefly as follows:

Chapter 1 Introduction

This chapter compromises a general introduction of this research, research objectives are included, and the key points of findings and results is considered. The structure of this thesis is also included.

Chapter 2 Background of Olive and Olive Oil Sector

Chapter two includes a general explanation for olive oil in the world market. The most important trends of the olive oil market are explained, including the production, consumption, imports and exports around the world, in EU countries and also in Syria. The world agriculture policy related to olive oil is included. The key legal frameworks effecting the olive oil sector in the UK market is in section 2.5. In addition, Syrian olive & olive oil sector takes a part of this chapter, including some key issues and challenges facing olive & olive oil growers, and export from Syria and the motivations and promotions for Syrian farmers have also been explained.

Also, the agriculture trade policy and Syrian-EU association agreement is mentioned and finally, the Syrian policy for quality of olive oil is provided.

Chapter 3 Literature Review

Chapter three includes empirical studies review for the first section. Theoretical framework of this study has been included in section 3.3 and consists of consumer behaviour theory and random utility theory. The last section of this chapter provides a methodological review of methods used in this study.

Chapter 4 Research Methodology

Research methodology in chapter four consists of qualitative research methods (focus group discussion and verbal protocol analysis) in section 4.2. the design of discrete choice experiment in included in 4.3. Research methods have been explained in detail in this chapter, first, Logit Model (LM), second, Probit Model (PM) and third Mixed Logit Model (ML) with three different specifications. The last section of this chapter includes an econometrics Bayesian approach to statistical inference.

Chapter 5 Data Collection and the Design of Discrete Choice Experiment

This chapter describes the study area in section 5.2. Determining the target population is explained in section 5.3. Sampling procedure & sample size & recruitment the participants & time scale included in section 5.4. Online survey design is also described in this chapter in section 5.5. Advantage & some limitation of conducting survey online in mentioned in 5.6. The strengths & weaknesses of choice experiment included in 5.7. Qualitative findings for focus group discussion and verbal protocol analysis explained in 5.8.

Chapter 6 Results & Discussion- Quantitative Methods

Chapter six contains summary statistics of survey data in the first section. In the second section, findings from debriefing questions included in the survey have been analysed by using two models Probit and Ordered Probit. Estimation results from mixed logit models and the interpretation of willingness to pay is discussed in the last section of this chapter.

Chapter 7 Policy Implications & Conclusion

Chapter seven includes a summary of the study and provides concluding remarks. Contribution of knowledge explained in section 7.3. This chapter also presents final recommendations and policy implications based on the study findings. Suggestion and future research is in section 7.6. Finally, limitations of study include in 7.7.

Appendices

Appendix 1 Conceptual Framework of Thesis

Appendix 2 Focus Group Protocol

Appendix 3 Verbal Protocol Analysis

Appendix 4 Questionnaire design

Chapter Two: Background of Olive and Olive Oil Sector

2.1 Introduction

In this chapter, a general explanation for olive oil in the world market is included, the most important trends of olive oil market are explained including the production, consumption, imports and exports around the world and in the EU countries, also in Syria. the world agriculture policy related to olive oil is included. European Union Policy related to olive oil is explained in section 2.4. This chapter explained the key legal framework effecting olive oil sector. In addition, Syrian olive & olive oil sector takes a part of this chapter, including some key issues and challenges facing olive & olive oil growers and the export sector in Syria, and the motivations and promotions for Syrian farmers have been explained. Also, the agriculture trade policy and Syrian-EU association agreement is mentioned and Syrian policy for quality of olive oil. Finally, the implications of market trends

2.2 Olive Oil in the World Market

Olive oil is a very versatile product with production concentrated in ten countries surrounding the Mediterranean Sea (FAO, 2011). Spain, Italy and Greece are the main producers of virgin olive oil followed by Tunisia, Syria, Turkey and Morocco (years 2002-2008). About 90 percent of the world production of olive fruit is for oil extraction, the remaining 10 percent for table olives (IOC, 2014). The world cultivated area of olives in 2013 was 10.2 million ha with an average yield of 2.1 tonne/ha (FAOSTAT, 2013). Suitable agronomic and climatic factors of the Mediterranean basin have contributed to the high quality of olive oil and table olives produced in this region (TiÓ, 1996). As a commodity olive oil has played a crucial role in the world market of vegetable oils, although the percentage share of olive oil in the world edible vegetable oil is still small, around 3.5% (TiÓ, 1996).

No written evidence has been found for the existence of the wild olive tree especially in prehistoric times. Excavations in the Aegean Sea have discovered fossilized olive leaves older than 60,000 years. Zampounis, (2006) reports that written evidence of the cultivation and production of olive oil from the 3rd millennium B.C. were found in the ruins of the kingdom of Ebla (i.e. North Syria). Expert navigators and traders contributed to spread the cultivation of the olive tree west across the Mediterranean. Over time, olive cultivation started to be a significant source of agriculture income. The versatile nature of olive oil and its nutritional properties have made it an integral part of what is called the "Mediterranean Diet". Thus, the production of olive oil product brought wealth and health advantages to the Mediterranean

people and became a part of every aspect of their life. It is widely valued around the world and especially in Europe for its nutritional, health and sensory properties.

Olive oil quality is a crucial factor contributing to a producer's competitiveness within the global market. Issues related to the definition of olive oil quality, standard level of product, testing and the taste of product are still a matter of considerable debate in the olive oil sector (USITC, 2013). Different distinct grades have been developed to indicate the quality of olive oil based on a variety of criteria, comprising the production methods and oil characteristics, (e.g. acidity, odour, flavours ...etc.). The grades initially developed were virgin olive oil, olive oil, refined olive oil and olive pomace oil Subsequently, olive oil has been classified based on a set of chemical and sensory (i.e. taste and smell) attributes, for example, free fatty acids, flavour, fruitiness.

Definitions and standards for virgin olive oil are mainly defined by European legislation, especially Commission Regulation (EC) No. 1019/2002 of 13 June 2002, on marketing standards for olive oil, and Commission Regulation (EC) No. 702/2007 of 21 June 2007, on the characteristics of olive oil and the relevant methods of analysis (Mariotti, 2014). The European legislation is considered the first reference around the world and it recognized many standard grades of olive oil related to particular qualities and market value (Based on quality criteria, three standards grades of olive oil have been regulated, for example, "Extra virgin olive oil", " Virgin olive oil" and " Lampante (or lamp) olive oil"). Also, there are some other organizations which define olive oil standard grades such as the International Olive Council (IOC: *www.internationaloliveoil.org/*), and the Codex Alimentarius Commission (*www.codexalimentarius.org/*).

The International Olive Council (IOC) defines the quality standards of olive oil under three different grade categories in terms of their physicochemical (e.g. free acidity, peroxide value) and organoleptic criteria. First, extra virgin olive oil (henceforth EVOO) where the virgin olive oil has a free acidity, expressed as oleic acid, of not more than 0.8 grams per 100 grams. Second, virgin olive oil which has a free acidity, expressed as oleic acid, of not more than 2 grams per 100 grams. Third, ordinary virgin olive oil where virgin olive oil has a free acidity, expressed as oleic acid, of not more than 3.3 grams per 100 grams. If the olive oil has more than 3.3 grams of oleic acid per 100 grams, then the IOC considers that oil is not suitable for the consumption. The simple meaning of word "virgin" is that the olives fruits is pressed to extract the oil. This extraction process of olive oil is without using heat or chemicals to obtain pure and unrefined oil. However, US Department of Agriculture (USDA) regulates grades of olive oil with a different system of categories.

The three categories regulated by the IOC standards are also based on evaluation of both positive and negative attributes (IOOC, 2005 & 2011). Extra virgin olive oil cannot include negative attributes (i.e. sensory defect), therefore, screening for negative sensory attributes is prerequisite of EVOO (Bertuccioli and Monteleone, 2014). However, the positive sensory attributes of EVOO are bitterness, pungency and fruitiness, and the following table 2.1 describes the positive sensory characteristics attributes of EVOO according to Bertuccioli and Monteleone, (2014).

Table 2.1: Positive Sensory Attributes of EVOO.

Sensory Attribute	**Description**
1. Fruity	Fruitiness includes a range of smells characteristic of oil such as fresh green ripe fruit (i.e. smelt directly as odour or retronasally as flavour in the mouth). These smells are based on cultivar, degree of maturity at harvest, and processing conditions.
2. Bitter	Bitterness is explored by the circumvallate papillae on the 'V' region of the tongue, and it can be tasted in the oil when the green olives are turning colour
3. Pungent	At the beginning of the season, "tingling sensation" characteristic can be found especially in green olive fruits and this is what is called pungent. It can be felt throughout the mouth cavity, particularly in the throat.

Source: Commission Regulation (EC) No 640/2008 of 4 July 2008 amending Regulation (EEC) No. 2568/91 on sensory characteristics of olive oil and the relevant methods of analysis.

Olive oil is not consumed alone; it is used with some other ingredients. Consumers who are unfamiliar with the taste of EVOO, will consider bitter, pungent …etc as negative attributes. This is supported by Caporale *et al.*, (2006). However, Tuorila and Recchia (2013) reported that the sensory attributes of EVOO such as bitterness and pungent are nasty for consumers and the appreciation of good qualities of EVOO require learning. Indeed, in spite of rejecting these attributes, over time, bitterness is adapted by consumers as a sensation characterizing as some products such as coffee, beer, and wine. There are many methods to test the olive oil quality. The most prominent testing for the olive oil is the "free acidity" test. Free acidity is expressed

as the percentage of oleic acid content of the oil. Free acidity in the oil is not the same as sourness or acidity as in other foods, also, free acidity cannot be tasted in olive oil, at least not at the levels normally present (VOSSEN, 2007). According to the IOC (2014) in an official journal publication, free acidity is a crude indicator of olive oil quality evaluation and its classification into commercial grades. This indicator is determined by (ISO, 2009) methods 660:2009, and it commonly called the percentage acidity or free acidity percentage.

2.3 Trends of Olive Oil Market: Major Players

In this section, trends of the olive oil market production, consumption import and export are reviewed for the world market and also for the EU countries and finally for Syria.

2.3.1 World Olive Oil Production & EU countries & Syria

According to the IOC statistics (2014), the world olive oil production for the season of 2014 was expected to be much higher than in 2012/2013 when output totalled 2.42 million tonnes. Initially assessed at 3.098 million tonnes in Nov/2013, the estimated production for 2014 was revised to 3.05 million tonnes.

Table 2.2 shows the average olive oil production of the major producers over the period 2009-2012 and the estimated production in 2013-2014. Figure 2.1 shows the world olive oil production from 1958-59 to 2013-14. As may be seen from table 2.2 the main olive oil producing regions are found across the Mediterranean basin in Europe and North Africa. For the season 2013/14, Spain produced the largest amount of the olive oil 1.536 million tonnes and Italy produced about 0.45 million tonnes of the world production. In 2013-2014 Greece expected a sharp decrease in production to a level 0.16 million tonne on account of adverse climatic factors. Portuguese olive oil production has been notably rising in the last few years and was higher than expected at 85,000 tonnes.

Table 2.2 Wold Olive Oil Production: Average for the Latest Four Crop Years and Figure for 2013/14 (10^3t).[1]

Production	Average 2009/10-2011/12	2013/14 (est.)
EU, of which:	**2071.9**	**2244.3**
Spain	1256.2	1536.6
Italy	421.2	450.0
Greece	318.4	157.5
Portugal	65.2	85.0
Other IOC countries, of which:	**803.6**	**647.0**
Tunisia	168.0	80.0
Syria	181.5	135.0
Turkey	173.3	130.0
Morocco	122.5	120.0
Algeria	49.8	62.0
Argentina	21.5	30.0
Jordan	21.3	25.0
Non-IOC producers	**73.1**	**93.0**
Total	**2948.7**	**2984.3**

Source: IOC newsletter 2014.

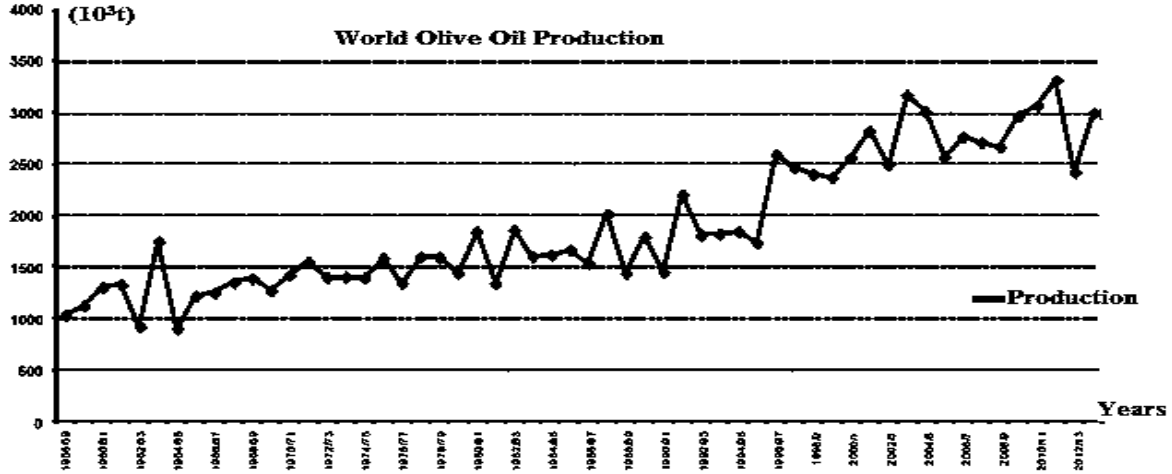


Figure 2.1: Trend of World Olive Oil Production, (10^3t). Between 1958/59 – 2013/14. Source: IOC Market Newsletter, 2014.

It may be seen from figure 2.2 that Spain has been the dominant producer of olive oil, even though it has suffered sharp declines in production in years such as 1995-96 and 2012-13. In 2013/14 Spain reached its peak in its olive oil production (1.78 million tonnes) (IOC, 2016). Italy the second largest producer reached its highest level of olive oil production in 2004 (0.879 million tonnes) but thereafter production has been declining due to environmental factors in the Mediterranean basin reaching a level of 0.22 million tonnes in 2014-15. Production levels in Syria and its neighbour Turkey are at similar levels. Production is Syria has declined over the period 2011-2016 due to the ongoing conflict.

[1] 10^3t = 1000 tonne.

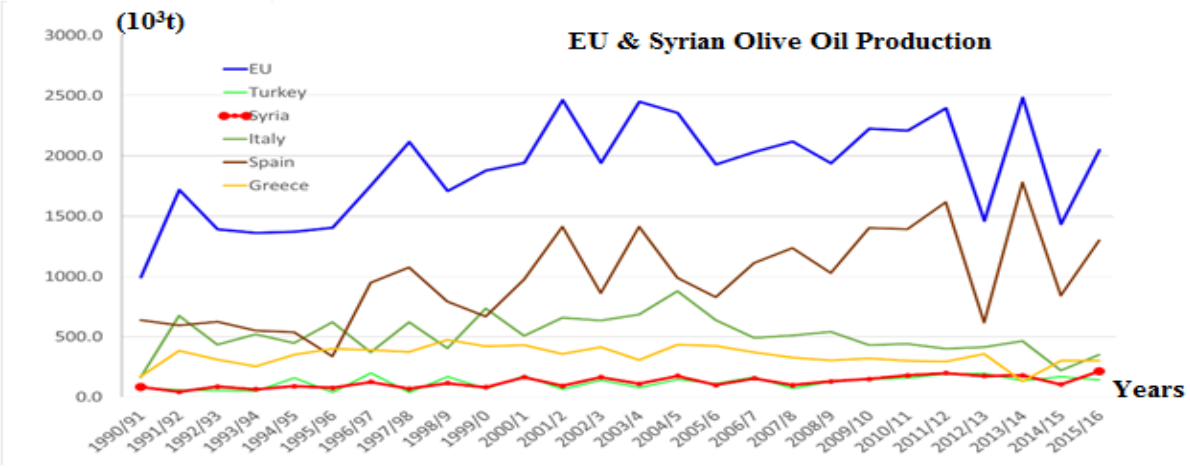


Figure 2.2: Trend of EU & Syrian Olive Oil Production (10^3t). Between 1990/91-2015/16. Source: IOC Database, 2016.

2.3.2 Olive Oil Consumption – World and EU Countries

World olive oil consumption is reported to have increased 1.8 fold in the period 1990/91 to 2015/16 according to statistics published by the IOC in February 2016. Figure 2.3 below shows that the share of consumption of non IOC member countries has increased from 11 pc to 24 pc over the same period. For EU countries, olive oil consumption was increasing till 2004/05, when it reached around 2 million tonnes then started to decline to the level of 1.6 million tonnes reached in 1996-97.

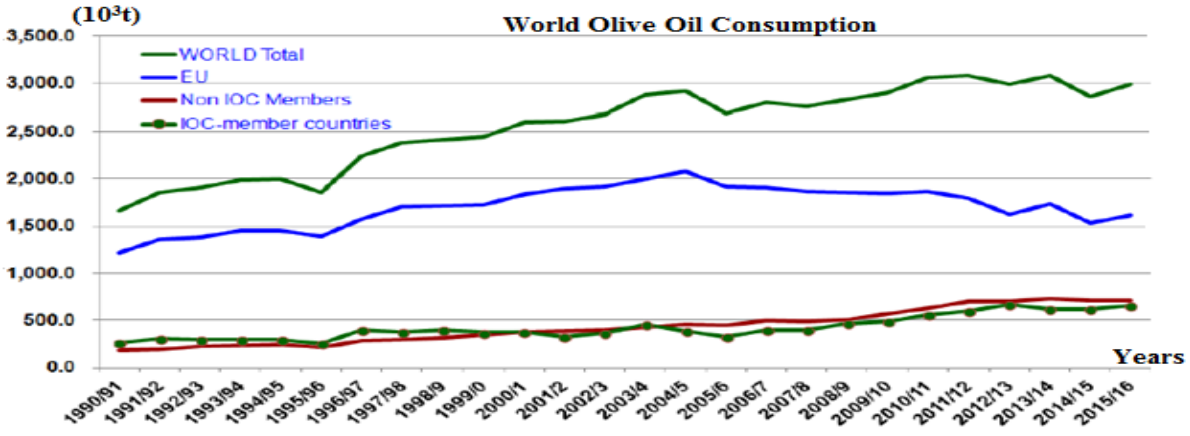


Figure 2.3: Trend of World Olive Oil Consumption, (10^3t). Between 1990/91-2015/16. Source: IOC Database, 2016.

As may be seen from figure 2.4 below, Italy is the largest consumer olive oil in the EU Olive oil consumption in Italy started to decline from 2006/07 and reached a level of 0.52 million tonnes in 2014/15. However, olive oil consumption in Spain has fluctuated reaching its lowest level in 1995-96 and the highest level in 2001-02. Greece is the third largest consumer of olive oil in the EU and consumption has shown a declining trend in consumption reaching a level of

0.16 million tonnes in 2015-16. This decline in consumption may be attributable to the current economic crisis in Greece and represents a fall in consumption of 22% compared with 20 years ago (IOC, 2016). It may also be seen from figure 2.4 that the olive oil consumption for producers' countries has increased reaching a level of 0.2 million tonnes.

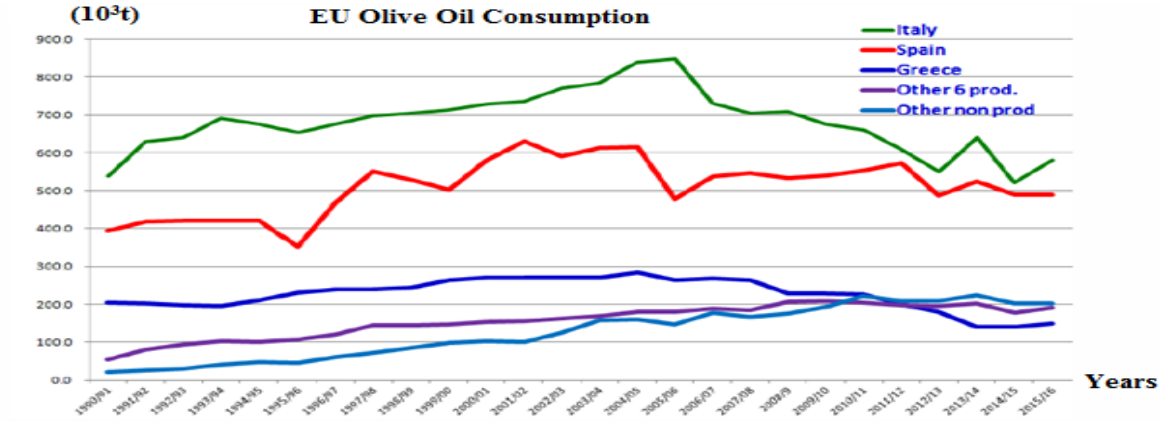


Figure 2.4: Trend of EU Olive Oil Consumption (10^3t). Between 1990/91-2015/16.
Source: IOC Market Newsletter, 2016.

Figure 2.5 below plots average production and consumption in the EU producer countries alongside prices. Two sharp peaks of price are seen in 2005/06 and 2014/15. The decline in Spanish and Italian olive oil production in 2014-15 is on account of environmental factors such as severe drought and this has been associated with a sharp rise in olive oil prices.

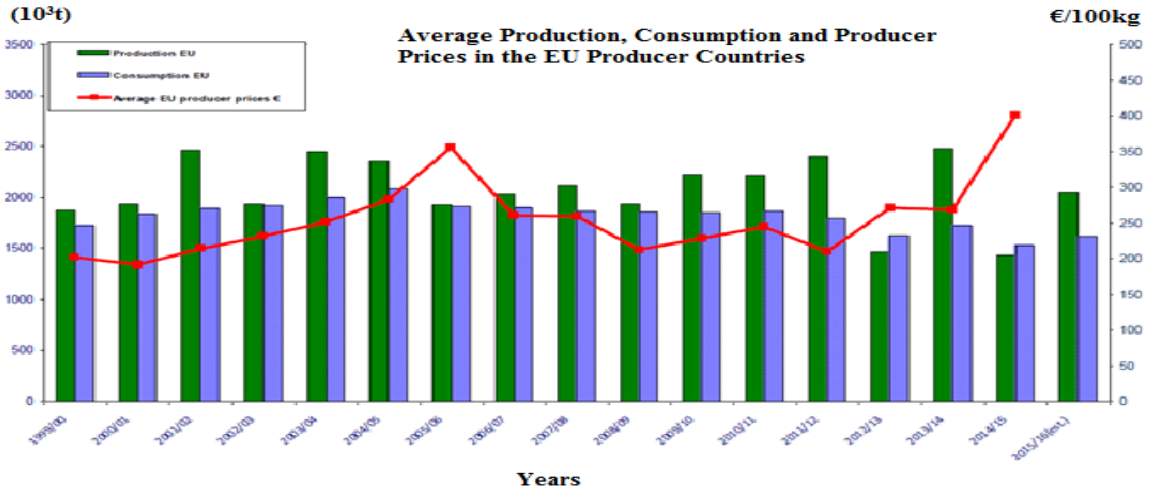


Figure 2.5: Average Production, Consumption and Producer Prices in the EU Producer Countries. (10^3t).
Source: IOC Market Newsletter, 2016.

Figure 2.6, compares the main producers and consumers of olive oil over the period 1990-2016. Spain is the largest producer of olive oil (37.1%) over that period and it moved to second position in consumption of olive oil. Tunisia produces 6.5 % of the world production and it is

in the fourth ranked producer of olive oil in the world. While Syria is placed in the fifth rank. The US in the fourth is the fourth largest consumer of olive oil.

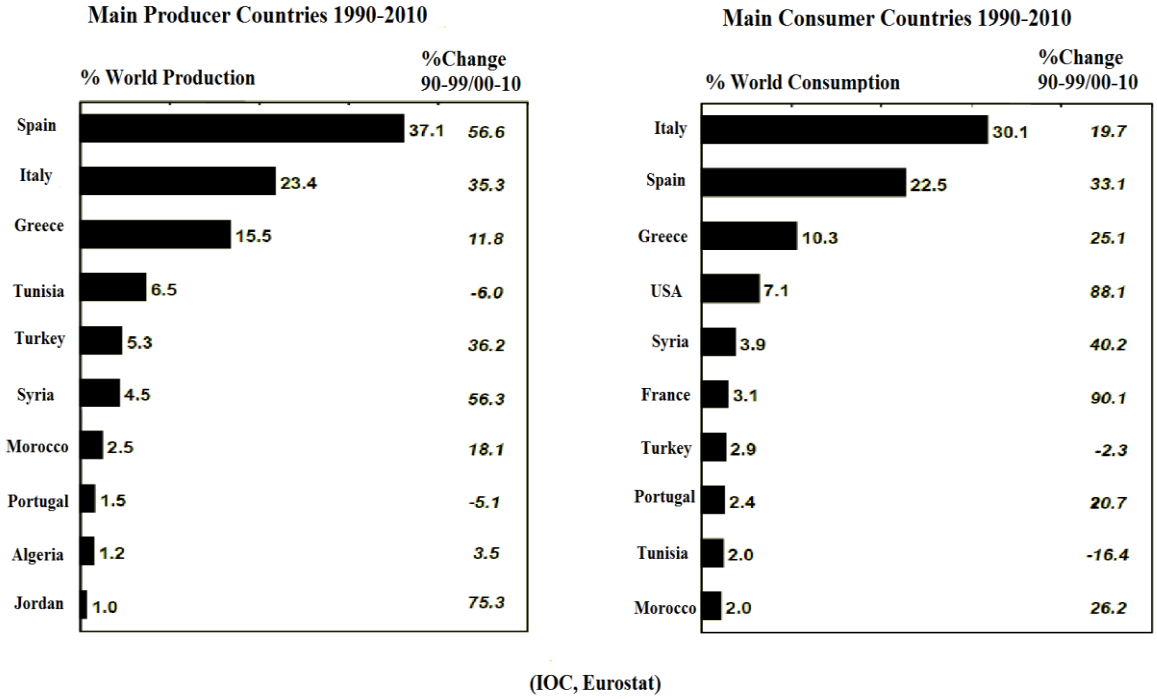


Figure 2.6: Main Producers & Consumers Countries. Between 1990/99-2000/10.
Source: The Olive Oil Value Chain: International Prospects and Challenges, 2010.

2.3.3 Exports & Import Trends of Olive Oil

As the Mediterranean countries are the main producers, olive oil export activities are centred in those countries (Figure 2.7). Italy is the largest exporter of olive oil, and its exports have shown an increasing trend over the period 1990-2015. Spain which is the largest producer of olive oil is the second largest exporter. Exports have been volatile in the years after 2011 as for instance in the case of Tunisia. Turkish exports have exceeded Syrian exports for most of this period. Portugal has emerged as a new exporter and is now the fifth largest exporter of olive oil.

It may be seen from figure 2.7 that Syrian exports showed an increasing trend from 2001-02 till 2006-07 which are associated with high levels of production reported over the same period. Syria accounts for around 2.9% of the world exports.

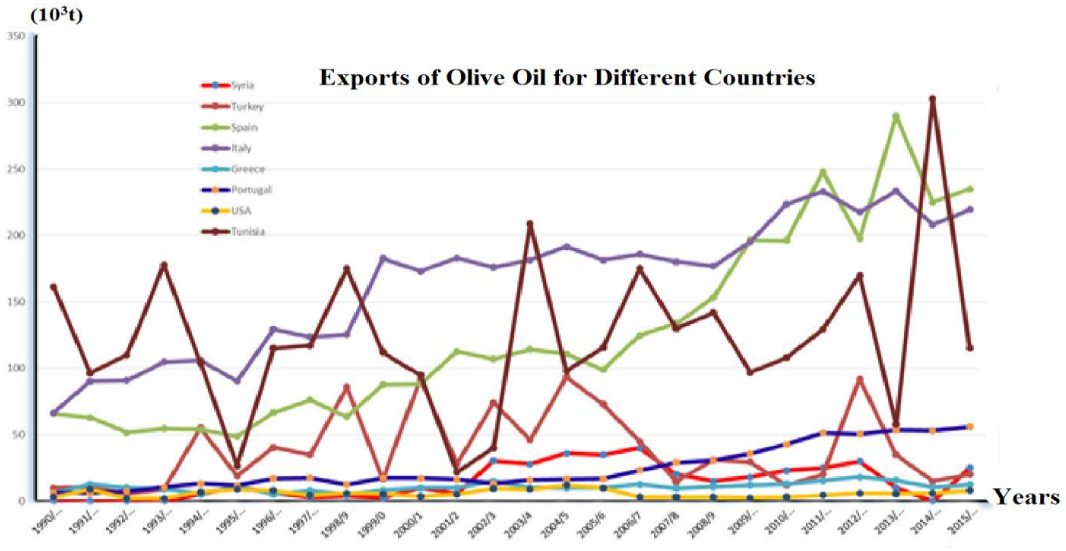


Figure 2.7: Exports of Olive Oil for Different Countries. (10^3t). Between 1990/91- 2015/16. Source: IOC Database, 2016.

Imports are centred in different countries, USA was with the largest importer with 35.4% of world imports, followed by Italy in the second position with 22.2 % and Spain 7.2%. Spain and Italy which are the largest producers import large quantities of olive oil in bulk for refining, bottling and re-exportation. Figure 2.8 shows that Syria does not import any olive oil which suggests that Syrian production is adequate for meeting domestic demand.

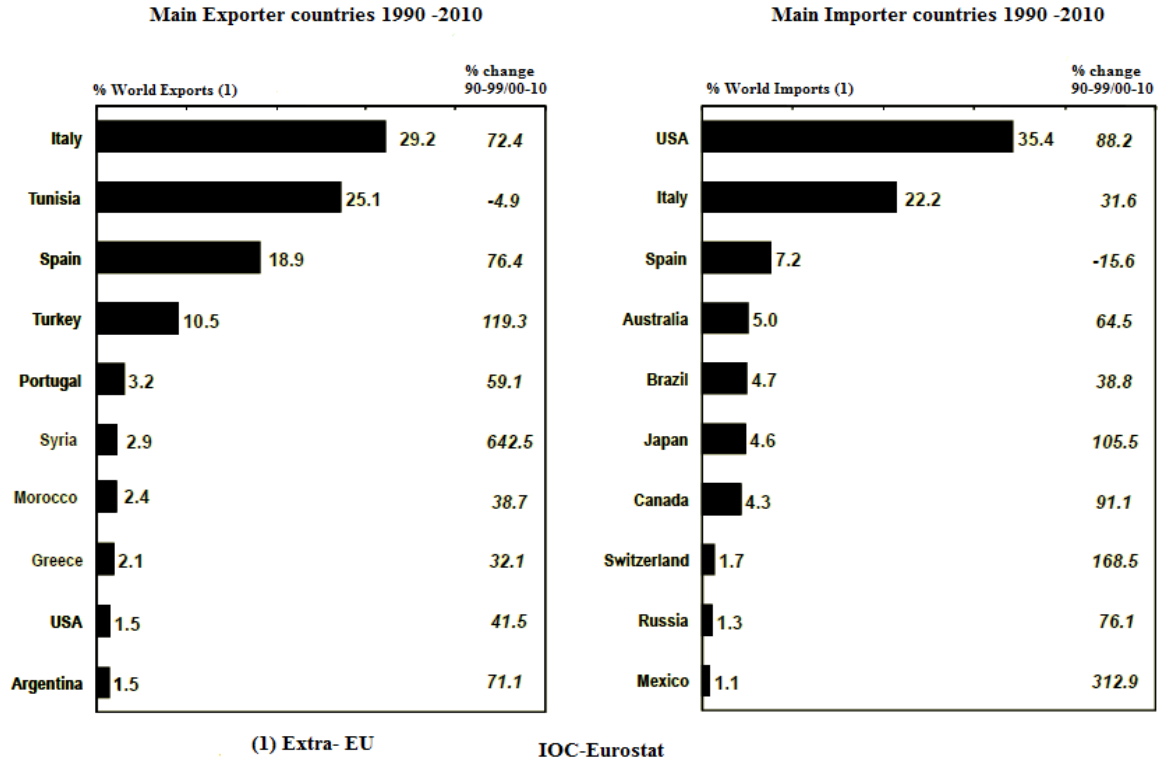


Figure 2.8: Main Exporter & Importer Countries. Between 1990/99- 2000/10. Source: IOC, Eurostat, 1990-2010.

2.4 European Union Policy Related to Olive Oil

EU is the dominant player in the global olive oil market accounting for 80% of production and 70% of consumption (Mohammad, 2009). EU policy, therefore, has a major role in the global olive oil market. The major aim of the EU olive oil policy is to maintain and strengthen its position in world markets by improving the quality of olive oil, through encouraging the production of olive oil and its benefits for growers, processors, traders and consumers. The budget for olive oil common market policy is over EUR 2.3 billion per year (European Commission, 2008). Three phases of EU olive oil policy can be distinguished. In the first phase, common organization of olive oil market was effected in 1966, including Italy and six more countries. They aimed to sustain the market price of olive oil, support the growers by giving some assistance and encourage and increase the ability of packaging olive oil. The EU also put some limits on the areas of production eligible for aid, determined minimum price levels, and granted some subsidies to help marketing outside the EU. Later, when the EU moved from the position of net importer to a net exporter, then these regulations were no longer appropriate and reforms were introduced in 1998 and 2001 in the second phase. In the 1998 reforms, the EU focused on improving information about the olive oil sector and took measures to ensure that assistance for growers was reaching the intended beneficiaries. The third phase of reforms from 2001 focused on quality issues and the "Quality strategy for olive oil" was developed. This focused on improving the extraction process techniques to get extra virgin olive oil of various types, improving product standard and marketing by development of standards for different grades of olive oil (with important implications for consumers choice and the price of olive oil received by the growers and processors). A portion of the assistance to producers was transferred to quality enhancement programmes.

The EU subsidies' policy for olive farmers were related to the level of production so farmers with a higher level of production would receive subsidies. The value of annual EU olive oil subsidies was $2.3 billion, the value of world trade in olive oil was $1.1 billion excluding the intra EU trade. This means EU olive oil subsidies were twice the value of the world olive oil trade (i.e. $2 of subsidies for each $1 of world trade). In addition, the olive oil world trade faced European tariffs of €1.2- €1.3 per kilo, the level of European olive oil subsidy ranged from less than €100/hectare in traditional areas (producing 500 KG/year), to more than €2000/hectare for mechanized and irrigated farms (producing more than 10000 KG/year). Also, the national guaranteed quota established by the Common Agricultural Policy (CAP) allocates certain quotas to European countries (760 000 tonnes for Spain and 543 000 tonnes for Italy) even though actual production is often higher (Mohammad, 2009). After that, EU Commission in

2003 reformed the CAP to increase competitiveness, stronger market–orientation, improve environment, and ensure stable incomes for olive farmers. To address all these issues, CAP reform readopted the subsidy forms awards. The policy focuses on encouraging the mass production and reduces intensive farming. This separation of subsidies from the amount of production was termed "decoupling" (European Commission, 2008). Grants would be given based on hectares of land and number of trees, and would be awarded under a Single Payment Scheme. This new payment plan would account for at least 60% of the average production-linked payments that were recorded from 1999 to 2003 (European Commission, 2008).

2.5 The key Legal Frameworks Effecting the Olive Oil Sector in the UK Market

2.5.1 Olive Oil Regulations and Inspections:

According to Commission Implementing Regulation (EU) No 29/2012 and Regulation (EU) No 1308/2013, marketers and retailers of olive oil products have to make certain that the oils (label & packaging) compatible with the EU regulations especially if the oil is prepared for sale (also online) to all consumers.

In terms of olive oil composition and characteristics, the European Commission regulation No 2568/91 have covered the chemical and sensory characteristics of olive oil product to meet the requirements (See: Commission Regulation (EEC) No 2568/91).

Under Directive 2000/13/EC, suggestions shown on the labelling may not mislead the purchaser, especially with related to the olive oil characteristics or it properties which it does not possess, or related to some possesses special characteristics which most olive oils have it. In this term, the common indications and suggestions used are the concepts of "cold extraction" or "cold pressing", which should correspond to a technically defined tradition production method. The organoleptic characteristics is described as "taste" and/or "smell" of extra virgin and virgin olive oils and defined by the International Olive Council (IOC) based on methods of analysis. Transitional arrangements are needed for certain operators presently using the reserved terms. Reference to acidity in isolation wrongly suggests a scale of absolute quality which is misleading for consumers since this factor represents a qualitative value only in relation to the other characteristics of the olive oil concerned. Consequently, in view of the proliferation of certain indications and of their economic significance, objective criteria for their uses should be established in order to introduce clarity into the olive oil market.

In terms of olive oil labelling, packaging and sealing, the following oils must meet labelling, packaging and sealing requirements under Commission Implementing Regulation (EU) No

29/2012 and Regulation (EU) No 1308/2013 of the European Parliament and of the Council, the label for certain categories of olive oil as following:

1- Extra virgin olive oil: superior category olive oil obtained directly from olives and solely by mechanical means.
2- Virgin olive oil: olive oil obtained directly from olives and solely by mechanical means.
3- Olive oil composed of refined olive oils and virgin olive oils: oil comprising exclusively olive oils that have undergone refining and oils obtained directly from olives.
4- Olive pomace oil: oil comprising exclusively oils obtained by treating the product obtained after the extraction of olive oil and oils obtained directly from olives.

If olive oil products are marketed in the UK, all the information that must be on the label must be in English or must include an English version. The labels for 'extra virgin olive oil' and 'virgin olive oil' must show a 'designation of origin' according to regulation 29/2012. For the purposes of this Regulation, 'designation of origin' indicates reference to a geographical area on the packaging or the label attached to the packaging.

1- In the case of olive oils originating from one member state or third country, a reference to the Member State, to the Union or to the third country, as appropriate; or
2- In the case of blends of olive oils originating, from more than one Member State or third country, one of the following mentions, as appropriate:

a- 'blend of olive oils of European Union origin' or a reference to the Union;
b- 'blend of olive oils not of European Union origin' or a reference to origin outside the Union;
c- blend of olive oils of European Union origin and not of European Union origin' or a reference to origin within the Union and outside the Union.

3- The labels for "extra virgin olive oil" and "virgin olive oil" have to show the designation of origin.
4- While the labels for "Olive oil composed of refined olive oils and virgin olive oils" or "pomace oil" should not illustrate the designation of origin.
5- For other information, label must include how the oil should be stored in dark and cold place. In addition, Under the regulation no 29/2012, explains what you must do if you want to include optional information on a label, for example, the degree of acidity or maximum acidity may appear only if it is accompanied by an indication, in lettering of the same size and in the

same visual field, of the peroxide value, the wax content and the ultraviolet absorption, determined in accordance with Regulation (EEC) No 2568/91.

In terms of packaging and sealing of olive oil, Under the regulation no 29/2012, olive oil should be presented to the final consumer in a "sealed" bottle or container that can't be "re-sealed" in packaging of a maximum capacity of 5 litres. In other words, olive oil packaging should be fitted with an opening system that can no longer be sealed after the first time it is opened and should be labelled in accordance with different categories and blend of vegetable oils (or the specific names of the vegetable oils concerned). However, for the oil consumption in restaurants, hospitals, canteens and other purposes, the Member States may set a maximum capacity more than 5 litres for packaging depending on the type of establishment concerned. In terms of labelling of blend olive oil, the description of blend olive oil should be in words or image or graphics as following: 'Blend of vegetable oils (or the specific names of the vegetable oils concerned) and olive oil', directly followed by the percentage of olive oil in the blend.

Under the same Commission Implementing Regulation (EU) No 29/2012 and Regulation (EU) No 1308/2013, if the olive oils products mixed with other flavours such as garlic, basil, chili…etc, the sales name on the label must not mix the grade of olive oil with the flavour, example, it must not use "extra virgin olive oil flavoured with pepper". The pure olive oil should be used form as following "extra virgin", "virgin", "composed of refined olive oil and virgin olive oil", "pomace". However, it is not allowed to be used additional word with the pure olive oil under the same regulation, example it is not allowed using "superior category olive oil obtained directly from olives and solely by mechanical means" if the olive oil is flavoured.

If the information included on the label does not follow the regulation then the local authorities have responsible for this information and should correct them as soon as possible. However, the retailers must correct the label information immediately when the information is appeared beside the product (e.g. a sign on a shelf or attached to an on-tap container.

Another matter should be taken into consideration in this regulation, it is the records that bottlers must keep. Anyone holding olive oil, from extraction up to, and including, the bottling stage must keep entry and withdrawal registers for each category of oil they hold. Under Statutory Instrument (SI) 2014/195 the register must show:

1- details of each delivery.

2- details of each despatch or disposal
3- details of any processing undertaken (such as blending or bottling)
4- a calculation of stocks held at the end of each month
5- a record of actual, physical stocks held at the end of each accounting period.

Under Statutory Instrument (SI) 2014/195, Rural Payments Agency (RPA) inspectors can legally carry out inspections at the premises of any bottlers, marketers, retailers or distributors of olive oil. They'll take samples of oil and check labels and records. The inspector will:

1- select the olive oil for chemical and sensory testing and take the necessary samples
2- check olive oil labels to make sure they comply with the labelling requirements
3- examine your entry and withdrawal register, if you are a bottler
4- check that you have documents showing your supplier, so the olive oil can be traced. If you can't supply this information, the inspector will give you 28 days to provide it to the RPA Olive Oil Sampling Manager

Throughout the inspection, no need to pay money for oil taken for test. Once a sample has been tested by the laboratory, RPA will tell the results and outcome by letter or email. If marketers don't agree with the chemical or sensory analysis of your sample, they can write to RPA within 14 days of receiving the result, to ask for a re-test. If the re-test still doesn't meet the requirements, it will be issued with a 'compliance notice'. If a sensory re-test fails, then will have to pay for it. If RPA inspectors find that you have not complied with the regulations, they'll let you know using a 'compliance notice'. This will tell you what's wrong, what you must do and the deadline. If you don't comply with the 'compliance notice' you may be prosecuted. If marketer doesn't agree with a 'compliance notice', s/he can write to RPA and ask them to review it. If marketer is still not happy after the review, s/he can appeal:

1- in England and Wales, to the General Regulatory Chamber of the First-tier Tribunal
2- in Scotland, to the relevant sheriff
3- in Northern Ireland, to the relevant magistrates' court

They must receive your appeal within 28 days of the date on the 'compliance notice'. Or, in Scotland or Northern Ireland, within the period given in the notice, if that is shorter. If s/he is not happy about the service they've received, they can complain to RPA.

2.6 Olive & Olive Oil Sector in Syria

There is an evidence, dating back to 2400 B.C., that Syria can be considered the cradle of olive farming. Specifically, an archive was discovered in the ancient city of Ebla in Edleb and consists of about twelve documents, showing that there were olive tree plantations in the property of the King and the Queen. Moreover, the archive cites 4000 jars of olive oil stored for the royal family and staff and 7000 jars for the people of the kingdom. It can be argued that from Syria, olive farming spread to other Mediterranean countries. The olive tree is considered a strategic agricultural choice for Syrian farmers in the arid and semi-arid areas due to the sector's stability in providing the essential food resources and job opportunities (Web: *http://www.oliveoilsyria.com/history.htm*). According to Migliorini (2011), the olive sector has offered a good contribution to the sustainable development of all the cultures in the Mediterranean basin, including Syria.

The olive tree is one of the oldest known cultivated plants in the world and the most important crop in the Mediterranean basin. Numerous studies indicate that it originated in Asia, particularly in Syria, and spread west on both sides of the Mediterranean Sea, reaching the Spanish shores during the Roman Empire (Figure 2.9). In the last decade before March /2011, olive is considered as a strategic crop in Syria due to its importance as a food security crop for the Syrian population and also its value addition to national income (SEF, 2016). It is a food security because first, olives were available in sufficient quantities for all people, the cultivated lands of olive spread widely and cover 65% of total planted lands of fruit trees. Second, Syrian households are able to access olive foods and they have enough resources to obtain a sufficient quantity and quality for a nutritious diet, its access can be through a local market or communities. Also, olives and olive oil are considered healthy food sources (i.e. it is full of fatty acids, vitamins, fiber and minerals). While the importance value of this sector is economically in its value-added. It can contribute in the national income, producers' returns, and help rural families in raising incomes and profits. SEF (2016) reports that olive oil engages in 1.5-3.5% of gross national income and 8% of total value of agricultural income. Workers participate on 19.1% of the total labour force working in agriculture sector according to World Bank database, 2008. However, olive production and olive oil exports from Syria have been adversely affected by the conflict situation especially in the last four years (WFP, 2015).

Figure 2.9: Origin and Distribution of Olive Tree in Mediterranean Region.
Source: Syrian National Strategic Plan for the Improvement of Olive Oil Quality. (Di Terlizzi B *et al.*, 2007).

In Syria, olive cultivation is the most important horticultural crop. Olive trees adapt well to a range of agro-climates and these trees can be seen in areas with very different rainfall rates. Olive trees are a natural resource which provide stable foodstuffs. Statistics provided by IOC (2009), 25 420 individuals work in olive development. Around 26% of them are females. Also, the olive trees have considerable economic significance in Syria as olive and olive oil are promising commodities with a high level of export potential which can enhance incomes of people in this sector.

According to 2009 statistics, the cultivated area of olives in Syria reached 635,690 hectares with 94 million trees. That represents about 10% of the total cultivated area and 65% of the total cultivated area of fruit trees (Al Ibrahim *et al.*, 2007) (Figure 2.10).

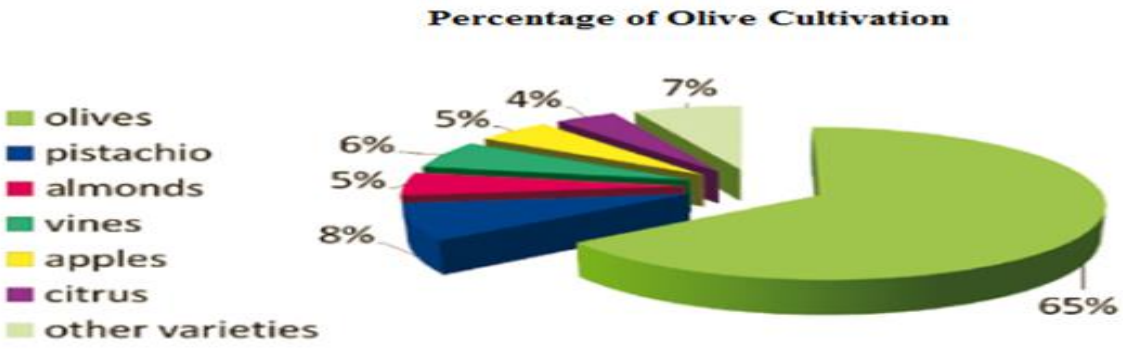


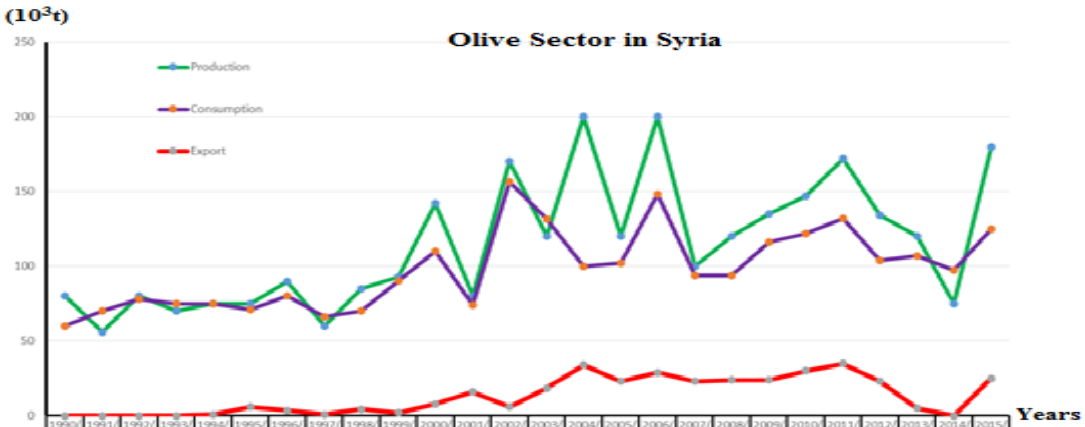
Figure 2.10: Percentage of Olive Cultivation, MAAR Survey Project. 2004-2006.
Source: Syrian National Strategic Plan for the Improvement of Olive Oil Quality. (Di Terlizzi B *et al.*, 2007).

According to IOC (2016), from figure 2.11, Syria continues to be one of the major olive growing producers in the Middle East (The highest level of olive production reached was 200 000 tonnes in two seasons 2004/05 and 2006/07). Syrian olive production has fluctuated over the crop years especially from 2001/02 to 2007/08 (this partially attributable to the alternate bearing phenomenon). Production continued to increase in the succeeding years from 2007/08 to 2011/12 till the commencement of the conflict in 2011. Significantly, there is a clear decline of Syrian olive production starting from 2011 to the lowest level of production in season 2014/15. The consumption of olives has fluctuated as well from year to year, and it is less than the production levels for most years except in 2014/15, where the consumption of olives (97 500 tonnes) exceeds the production of olive (75 000 tonnes). The opportunity to export olive products started to increase between 1994/95- 2011/12, till it was impacted by the commencement of the conflict in 2011. Two varieties of olive are very important in Syria for table olive production as following in table 2.3.

Table 2.3: The Most Important Syrian Olive Varieties for Table Olive.

Olive Type	**Description**
1. Abou - Satl	- Located mainly in Palmyra Oasis, at the middle part in Syria. - It is vigorous and hardy due to its tolerance of cold, drought and salinity. - Alternate bearing, and it is used for table olive because has low level of oil
2. Kaissy	- Located mainly in North and south regions in Syria - It is tolerant to, drought and has resistance to some diseases. - Used mainly for table olive and pickling. Also, it is alternate bearing.

Source: International Olive Council & UN.



	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/9	1999/0	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Production	80	56	80	70	75	75	90	60	85	93	142	80	170	120	200	120	200	100	120	135	147	172	134	120	75	180
Consumption	60	70	78	75	75	71	80	66	70	90.5	110	74	156.5	131.5	100	102	148	94	94	116	122	132	104	107	97.5	125
Export	0	0	0	0	1	6	3.5	1	4.5	2	8	16	6	18.5	34	23	29	23	24	24	30	35	23	5	0	25

Figure 2.11: Olive Sector in Syria (Production/Consumption/Export), (10^3t). 1990/91-2015/16. Source: IOC database, 2016.

As a centre for origin and diversity for olives, there are a large number of olive varieties available in Syria. The most significant varieties in terms of extracting high quality oil in a high productivity are listed in the table 2.4.

Table 2.4: The Most Important Syrian Olive Varieties for Oil Extraction.

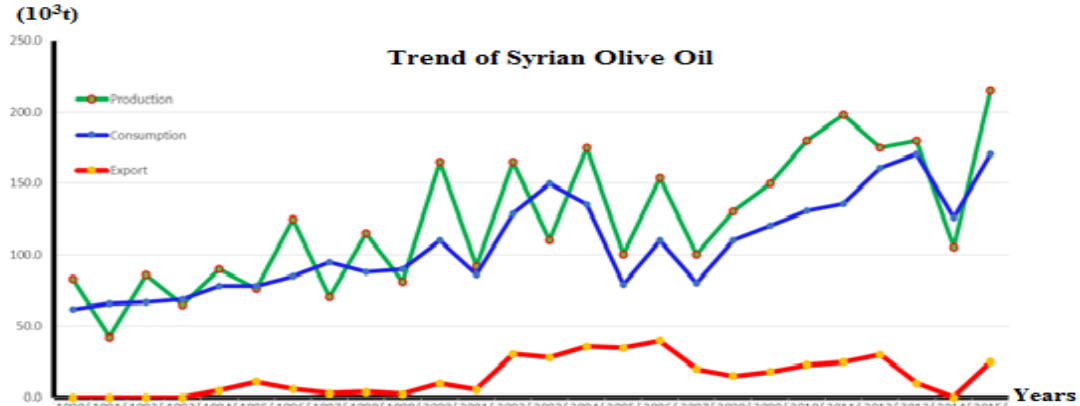
Olive Type	**Description**
1.Sorani	- Located mainly in north and north-western part of Syria, Aleppo, Hama, and Idleb. - Productivity is medium, alternate, and it is tolerant of cold, drought and salinity. - It is dual-purpose variety; it contains high level of excellent quality oil and use for pickling as well.
2.Zaity	- Located mainly in Aleppo region and it is expanded to other sides of the country. - Productivity is high, alternate, and it is tolerant of cold, salinity and resist some diseases. - Used mainly for extracting high quality oil.
3.Doebli	- Located mainly in Lattakia, Tartus and Tel-Kalakh and adapts to damp areas. - Productivity is medium, comes into bearing late, have little tolerance to drought. - It is a dual-purpose variety; it contains medium level of excellent quality oil.

Source: International Olive Council & UN.

It may be seen from figure 2.12 that the production of olive oil has fluctuated over the period 1990/91 to 2008/09 reaching its highest level of olive oil production of about 175 000 t in 2004/05. After that, the production continued to increase gradually till 2011/12 after which the civil conflict appears to have affected production, which is clearly noticeable in 2014-15. However, in 2015/16 the production of olive oil is expected to increase to 215 000 tonnes.

Syrian consumption of olive oil is related to two factors; first, the level of domestic production and the amount of that production left over after exports, which affect domestic prices. In 2010, per capita consumption of olive oil came to 7 kg/inhabitant (IOC questionnaire, 2012). The consumption trend of olive oil products nearly matches the production level. However, it can be seen that in some years the consumption level exceeds the production one for example, in 2003/04 and 2014/15. Syria, however, does not import any olive oil.

With an increase in production, Syrian exports of olive oil also increased reaching a peak of 40,000 tonnes in 2006/07. However, no data is available on exports in 2014/15. According to Mohammad, (2009), Syrian olive oil exports enjoy ***Relative Comparative Advantage***[2] which was 10.6 in 2005 and 14.0 in 2006. In addition, Syrian olive oil exports are classified as ***Champions***[3] on Syrian agriculture trade map (SAT, 2007). A key question to consider is whether Syrian exports can recover to the levels reached before the conflict and regain its market share.



	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/9	1999/0	2000/1	2001/2	2002/3	2003/4	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Production	83.0	42.0	86.0	65.0	90.0	76.0	125.0	70.0	115.0	81.0	165.0	92.0	165.0	110.0	175.0	100.0	154.0	100.0	130.0	150.0	180.0	198.0	175.0	180.0	105.0	215.0
Consumption	62.0	66.0	67	69.0	78.0	78.0	85.0	95.0	88.0	90.0	110.0	86.0	128.5	150.0	135.0	79.0	110.0	80.0	110.0	120.5	130.5	135.5	160.5	170.5	126.0	170.5
Export	0	0	0	0.0	5.0	11.0	6.0	3.0	4.0	2.5	10.0	5.5	30.5	28.0	36.0	35.0	40.0	20.0	15.0	18.0	23.0	25.0	30.0	10.0	0.0	25.0

[2] According to NAPC, (2009) refer that RCA index is an important indicator to evaluate product competitiveness in foreign markets. RCA calculates in an equation as following: RCA = (value of Syrian exports of a given product / value of world exports of the same product) / (value of total Syrian agriculture exports / value of total world agriculture exports). When RCA > 1, then the country has RCA of the commodity or product which must get an interest.

[3] It was proved that some products of Syrian export have been performed very well in terms of increasing share in the world imports. Also, it was proved by the exporters of these products that those products have international competitiveness in the same study. Promotional trade efforts of these products were successful in the world market and it can be considered as a reference points. Moreover, these efforts should aim to enlarge the supply capacity of these products with providing evidence.

Figure 2.12: Trends of Syrian Olive Oil, (Production/Consumption/Export), (10^3t). 1990/91-2015/16. Source: IOC database, 2016.

Organic olive farming in Syria is still in the early stages. At this early stage, the Ministry of Agriculture and Agrarian Reform (MAAR) is working towards the reduction of the use of chemical pesticides by applying the Integrated Pest Management (IPM) Program on citrus and olive trees, and through other measures including intensive extension seminars to help farmers stop using chemical methods in planation. Some of those farmers have shown good results and have the willingness and ability to move towards organic farming.

According to the General Commission for Scientific Agricultural Research (GCSAR, 2007), the total number of organic farms in Syria was 3256, occupying in total 28461 ha (Table 2.5). Some of these farms are still under the organic transition stage. Organic olive oil production has started on a very small scale and production is estimated by (IOC, 2010) at about 250 tonne. While no organic table olives are produced in those farms.

Table 2.5: Organic Agricultural Area in Syria.

Crop	**Number of Farms**	**Area (ha)**
Cotton	3226	27881
Olive	29	570
Grapes	1	10
Total	3256	28461

Source: GCSAR, 2007 (*In*: Survey on Consumers and Organic Food Market Potential in Syria.)

In Syria, like other Mediterranean countries, the traditional Mediterranean diet, including olive oil, is highly valued for its nutritional characteristics and health benefits. More than 200,000 families (around one million people) depend directly or indirectly on olive farming income. In addition, the development of organic farming gives farmers the opportunity to increase their income and returns and improve their level of living by getting involved in olives cultivation and oil production and trade. In this context, organic agriculture and the export of organic olive products can be considered a potential source of foreign exchange earnings needed for development.

The main problem in the olive sector in Syria has been that "the quantity exceeded the quality". In other words, the surplus of production has been growing at a faster rate than consumption and this is mainly because the quality of organic oil does not meet international standards. Therefore, opportunities to export for a larger contribution to the Syrian economy are not fully developed. These issues force the government and other decision makers to reconsider and re-

evaluate the current procedures of moving to organic farming and use new strategies for organic olive oil production, in order to match the quality of European olive oil brands.

Organic olives in 2007 were cultivated on 362.000 hectares and it represented 4.9% of the total olive area and 11% of the total organic land in the Mediterranean countries (Santucci, 2010). Most of the organic olive cultivation is carried out in Spain which is considered the largest grower of organic olives, followed by Italy, Greece, Tunisia and Syria.

In many developing countries, (El Hage Scialabba and Hattam, 2002, Rundgren, 2008) pointed out that the production of organic products is still considered as being mainly relevant for foreign markets, with domestic markets being very small. At the same time, it can be seen that an awareness of organic products has been growing fast in the last few decades. The reason for that is the organic plantation requires less cost and it is more resilient. Monotti (2007) indicated that the high cost of getting certification standards of organic products, the lack of knowledge amongst farmers about organic produce cultivation, the trading process and the market, are factors that hinder the development of organic agriculture. Al-Bitar, (2006) pointed out that Mediterranean organic agriculture is still in a starting phase and the data related to the organic sector is not available to a large extent, which is considered the major weakness for this sector.

The olive sector in Syria has been suffering from a number of obstacles relating to its cultivation environment of olive sector, such as unstable yield due to the alternate bearing phenomena, where the production will be under the system of "year-on" and "year-off" relating to the olive production. Santucci (2010), in the seminar held in NAPC in Syria, referred to the scarcity of water resources as the greater obstacle to the agriculture sector. Even though, he explained, there was a strong desire to shift many of the farms from conventional systems to organic, this was impossible because organic plantation required a great deal of water resources to get a high level of productivity. Additional issues were the unknown potentials of local varieties, soil erosion, inadequate pruning and inadequate disease management.

The Syrian organic olive oil market faces many challenges. Amongst these is the non-existence of a local organic olive oil market, the competitiveness of well-known European companies as well as the fact that certificates of organic certification are not yet issued in Syria. In order to face all these challenges, the Syrian Ministry of Agriculture and Agrarian Reform, took various measures in order to set up a national strategic plan for the improvement of the quality of the olive oil produced in the country. For example, the Italian-Syrian project, entitled "Technical Assistance for the Improvement of Olive Oil Quality in Syria" was held in Syria with the contribution of FAO (2007), with the aim of providing a sustainable and improved olive oil

quality. The project, led by a team of experts, is funded by the Italian Ministry of Foreign Affairs and jointly implemented by the International Centre for Advanced Mediterranean Agronomic Studies – Mediterranean Agronomic Institute – Bari (CIHAM- IAMB) in Italy and the Syrian General Commission for Scientific Agricultural Research (GCSAR).

Syria has the ability to produce the olive crops at a lower level of cost; this, in its turn, gives the organic olive oil product a comparative advantage. At the same time, the increase of the international consumer demand for organic products, including organic olive oil, and the huge diversity of organic commodities, give new export opportunities to the Syrian olive oil. Al Ashkar (2007) pointed out in his research that Syrian olive oil has a comparative advantage, which in its turn, can help the Syrian government to take several steps to improve the olive and the olive oil sector in different areas such as: olive cultivation, trade, technical and quality aspects. In regard to olive cultivation, with the co-operation of MAAR, the Syrian government focused its efforts towards the reclaiming of lands, giving farmers olive seedlings at subsidized prices, holding various extension programs and services and concentrating on the integrated pest management (IPM).

In regard to trade policies, Syria became a member of the IOOC in 1998. In terms of trade liberalization, the expansion of agricultural trade was the first measure taken by the government for the development of the agriculture sector. As a result, all exports of agriculture goods and products have been exempted from income taxes. Moreover, exporters are required to comply with instructions and regulations in relation to a quality standard. Exporters are asked to keep the product label including the nature of the product, showing all the contents on the label, the name and the address of the factory, and the statement of "For export "should be written on the product. In addition, the country of destination has to be included on the label.

The government was keen to encourage and support olive and olive oil sector in terms of providing loans to establish new olive orchards or to upgrade existing groves. Also, the Ministry of Agriculture and Agrarian Reform has been taken some specific actions to improve this sector such as the creation of olive plant nurseries, importation of tillage tools, and design of projects to establish new system of irrigation especially in the northern part of Syria. In addition, the Olive Bureau has been set up to carry out research, disseminating new techniques to olive growers and keeping them up to date in different ways. Another centre called Bouka Olive Oil in Lattakia city is essentially focused on training middle technical managers and prioritises olive research thorough new laboratory centred in Damascus. (IOC, 2012).

2.7 Key Issues & Challenges Facing Olive & Olive Oil Growers & Export Sector in Syria

The main agronomic issue of the olive sector is the density of plantation. In the *Syria Survey Project (2004-2006)*, the number of olive trees is recorded at 80 million trees spread on 544 000 ha, with average 147 tree/ha. The density of plantation depends on the region, for example, in the north of Syria, the density of olive trees is around 100-115 trees/ha, while in the coastal areas it is be possible to find around 200-210 trees/ha with complementary irrigation. In some regions where there is a regular irrigation for olive trees, the number of olive tree can reach 300 trees/ha. There are two key issues. The first is the provision of technical and financial support in the regions for creating an efficient irrigation system. The second is the young age profile of the trees (partially the result of the 1949 frost that caused the death of a million trees in northern Syria), after 1949, the plantation of young olive trees is spread in a wide range in the country which are still unproductive or weakly productive (57% trees from 1-20 years old, 38% trees from 21-70 years, only 5% trees greater than 70 years) (Al Ibrahim *et al*., 2007).

There are some major issues and challenges facing the olive oil growers and Syrian olive oil exports; Syrian olive oil faces intense competition from well-known European companies especially some Italian and Spanish companies which have a well-established reputation of excellent quality olive oil and a dominant position in international olive oil exports. This can reduce the potential for Syrian olive oil exports. Further, Syrian olive oil is a relatively new product that has been introduced recently in the international market. It, therefore, requires substantial marketing and promotional support to garner consumer acceptance in international markets. Many Syrian farmers are inexperienced in using advanced olive oil extraction methods. Their use of traditional methods, especially in relation to harvesting and delaying the pressing process, which is considered the main factor that increases the degree of acidity in olive oil, results in the production of olive oil of lower quality that may not be competitive in global markets.

As noted earlier, the organic olive sector in Syria is still in the early stages of development. According to a Delphi survey, the prediction is that there will be a 4.5% increase in the overall production of organic food products in Syria (Monotti, 2007). However, the transition to organic farming and the establishment of the organic sector in Syria faces several hurdles; the first issue is that there is no domestic market in Syria for organic products in general and in particular for organic olive oil. The absence of a domestic market is a significant obstacle and discourages local farmers from increasing their productivity or committing to a long-term sustainability agenda on organic agriculture. In addition, the widespread lack of knowledge and information on organic olive oil among Syrian people is another factor inhibiting the

development of the local market. The second issue is related to the regulatory infrastructure - certificates of organic certification are not yet issued to farms and this absence of accreditation discourages the local farmers who are interested in exporting their productions abroad. As a result, farmers who export abroad have to pay high registration fees as well as the full cost of an inspector's trip to their farms. Of course, the cost of accreditation depends on the size of the farm. This is an additional obstacle to farmers who are interested in producing organic olive oil in Syria. Finally, there is a significant lack of technical and scientific knowledge about the application of organic production methods, insufficient research on relevant issues and therefore poor identification of the various problems that result from the absence of expertise and infrastructure in processing technology.

2.8 Motivation and Promotion for Syrian Farmers

Before the outbreak of Syrian civil war in March 2011, Syria was globally the fourth largest olive oil producer (IOC, 2012). Olive oil production was estimated by IOC to have reached 198 000 tonnes in 2011/12 while present information about the Syrian olive oil sector is quite limited due to political unrest. Production levels of olive oil have been affected and started to decline since the advent of Syrian war and Syrian participation in international olive oil market is now very limited (TiÓ, 1996). Before the war and over the period 1990-2000 many measures were initiated by the Syrian government to raise olive & olive oil production. As a result of the conflict and consequent disruption in supplies, Syrian olive oil is not preferred by major international marketer and purchasers. The exports have started to be directed to other Middle Eastern countries in the Gulf on account of the difficulties and expense of shipping goods across borders (TiÓ, 1996).

Key measures taken by the Syrian Government to promote the olive and olive oil sector are discussed below. Syrian promotion policies can be divided into two parts: first part relates to direct promotion policies which include subsidies, grants and loans.

The first element of these policies aims at increase production. The Syrian government gave this point priority, based on the importance of the organic olive and olive oil sector in the Syrian economy. This was sought by reclaiming of large areas of previously privately-owned land, distributing the land to olive farmers and the provision of subsidies, soft loans and seedlings adapted to the Syrian environment to farmers aimed at encouraging them to move from traditional methods to organic ones. Furthermore, the Ministry of Agriculture and Agrarian Reform (MAAR) has applied the Integrated Pest Management program to control many olive diseases which cause decrease in production. In addition, MAAR has provided an intensive

extension program, free of charge, to the farmers to help them increase the productivity and the quality of products.

The second element of direct promotion policies relating to the olive sector concentrates on opening up the economy to trade and free markets. Until 2011, the Syrian government had signed many agreements, for example, the Syrian-EU Association Agreement to establish free trade zones of manufactures and the extension of mutual concessions for agriculture goods. In addition to the aforementioned points, the Syrian government has given various companies the authorization to export olive oil that conform to international standards and with the cooperation of the Ministry of Trade and Economy.

The second part of Syrian government policy relates to indirect promotion through foreign organizations and projects in collaboration with the government. Indirect promotion happens through foreign organizations and projects with the government and Non-Government Organizations (NGOs). Various organisations develop and run projects in Syria. For example:

1. In 2004, the European Action Plan was started after long negotiations with the government and it is working rapidly in the Mediterranean countries. Malorgio, (2008) underlines that an extended conversion from conventional or traditional farming into knowledge intensive organic agriculture food chains is needed.
2. In 2006, the FAO project "Institutional Development of Organic Agriculture in Syria" began, with its main focus on organic agriculture as a sustainable resource.
3. International Centre for Agricultural Research in the Dry Areas (ICARDA). It launched a programme titled "The Development and Dissemination of Sustainable Irrigation Management in Olive Growing in Syria". The objective of this programme to help smallholder farmers to increase olive productivity on small-scale farms, by encouraging farmers to use improved irrigation system, and cope with the issue of yield fluctuation, this helps to get more stable farm income. The project also focused on increasing the productivity of water used in farms irrigation.

The development of the organic olive oil sector is at an early stage in Syria and suffers from the absence of national legislation and the lack of a legal infrastructure to push it forward. In January 22, 2012, the law of organic farming was issued in Syria. The decree aims to put into effect the foundation strategies for the improvement of organic production of several products such as cotton and olive oil, and to market them abroad. In order to face all these challenges, the organic olive oil sector needs serious government support as well as the establishment of a local certifying body to lower the accreditation costs and help the farmers to adopt organic farming. The development of the organic sector will give Syria, a developing country, many

economic, environmental, social and cultural benefits. Realising the potential of the organic sector requires concerted action by farmers, policy makers and the government, especially in the context of the rapid growth of the international organic market.

2.9 Agricultural Trade Policy and Syrian-EU Association Agreement

As agriculture is one of the main pillars of the Syrian economy, Syria has pursued and signed a series of trade agreements, including several involving the EU and WTO. It is noticeable that there is a high degree of government intervention in Syria on issues of agricultural trade policy. In addition, since 1987, the government has tried to implement various reforms, such as the simplification of import and export procedures in order to remove existing obstacles for the production and marketing abroad of organic food products (Garcia, 2003).

Agricultural and agro-food producers during the 1990s accounted about 18 – 30% of total exports and the government gave authorization to the private sector to use the foreign currency proceeds to import production inputs and food staples (Garcia, 2003)

As a measure of trade reforms, "tariffs are the main policy instruments to regulate trade flows in Syria." (P, 1). The elimination of non-tariff trade barriers, given their supposed importance, could have a much greater leverage on Syrian economic activity, and would represent an important and critical aspect of a broader reform agenda (Chemingui and Dessus, 2003).

In 1995, the Euro-Mediterranean Partnership (Barcelona Process) was launched and provided the framework of the agreement between the EU and twelve Mediterranean countries, including Syria. The main aim of the agreement was to create by the year 2010 a free trade zone, also known as export processing zone. The purpose of the zone was to eliminate tariffs, quotas and preferences on most goods.

In 2003, the government held several negotiations for the Association Agreement with the EU that led to the initial signing of the agreement in 2004. Syria awaits the agreement finalization before applying for WTO Membership. The Association Agreement with the EU enables Syria to commit to the harmonization of domestic laws and standards with international laws, thus making it easier for Syrian producers to penetrate international markets. Moreover, the EU has committed to the provision of financial assistance for the adjustment costs that will result from the free trade agreement (Garcia, 2003).

Regarding WTO membership, Syria can take significant steps towards full membership if sustained consideration is given to the restructuring of the existing agricultural and food policy instruments. With respect to agricultural import and export operations, the degree of protection granted to specific commodities would need to be reduced further and the tariff system

simplified and made more transparent. Non-tariff measures such as quantitative import constraints would need to be abolished and transformed into tariffs. Ideal instruments are those agricultural support measures which are classified by the WTO as 'green box' measures, i.e. instruments which are distorting trade only minimally. Green box examples are direct, decoupled income payments for farmers, or investments in rural infrastructure and agricultural research (Wehrheim, 2003).

At the beginning of 2005, Syria started to fully implement the provisions of the Great Arab Free Trade Area (GAFTA). This agreement significantly affected the domestic market for many agricultural goods as products from GAFTA member states flooded the Syrian market and improved the export of Syrian agricultural products to Arab countries.

2.10 Syrian Policy for Quality of Olive Oil

Governments often intervene in international trade through ***tariff and quotas,*** the aim of this increasing exports or reducing imports. Tariff is a tax on imports and usually is imposed by the government on specific goods and commodities. In an economic context, tariff deals with the price of the goods. When the country imposes a tariff, then the price is increased and this in its turn will affect consumption by reducing consumer demand. There is another effect of a tariff, which is increasing the domestic output due to the fact that the high price encourages the producer to produce more. However, quota is a quantity limit and it can be considered as a restriction on imports of goods physically. Put differently, the quotas specify the maximum amount of imported good in a given period of time. Some advantages of imposing quotas can be seen on the foreign exchange implication by keeping the volume of imports unchanged even when the demand for imported goods increases. Also, the outcome of quotas is precise and certain because the volume of imports remains unchanged.

Despite of the import of olive oil in Syria was in a very limit amount. There are some recommendations by Brillante *et al.,* (2007) related to a policy for quality of Syrian olive oil, they suggested that the increasing of virgin olive oil quota will improve the international picture for Syrian olive oil in an emerging market. Also, imposing quota on Syrian olive oil is an important for secure farmers' income especially with having a long expiry date for EVOO. Finally, it will be useful to record the quantity and the quality of Syrian olive oil exported abroad especially for the main grades of olive oil (i.e. EVOO, Virgin, Lampante).

2.11 Implications of Market Trends on Syrian Export Olive Oil

Olive oil is considered a high-quality product in comparison with other edible oils and fats. In the EU-Mediterranean countries, olive oil quality has improved to meet consumers' preferences in an international emerging market such as UK market. Also, the diversity of grades of olive

oils which existed in Mediterranean countries (i.e. extra virgin, virgin, blend, pomace …etc) contributed to face the consumers' preferences of EU consumers and in the global market as well. As mentioned earlier, the Mediterranean countries like Spain and Italy and Greece are considered the main producers and exporters of olive oil, they have a strong position in the global olive oil market.

On the supply side, as explained before, the fluctuation of market trends (production, consumption and trade) based on some adverse climatic factors for major players' countries has affected these countries to export abroad (e.g. Italian olive oil production declined from 2004/05 to 2015/16, Spain has suffered sharp declines in production in 1995/96 and in 2012/13). At the same time, Syria is one of significant producing countries in the Mediterranean basin in olive and olive oil. Due to relative comparative advantage in producing olive oil with low cost production and high level of quality, Syria may drive benefits by engaging in an international trade with some other Mediterranean countries. This in its turn may give Syria opportunity to enter into an international emerging market and export olive oil to UK market.

On demand side, in non-tradition market (i.e.UK), it is supposed to have a wide scope for increasing demand of olive oil, British consumers' preferences and behaviours vary significantly in their choice of olive oil based on the different brand names, taste, flavour, CoO, labelling and prices. FAO statistic (2014), UK ranked sixth among other olive oil importers in the world, the share of the UK imports in the international olive oil market reached 3.82% while it was 0.6% in 1990. Paisiadis (2015) mentioned that 50% of UK households have increased the use of olive oils while it was 31% in 2001. The consumption of olive oil in UK was 62 000 tonnes in season 2013-14 and exceeded the consumption in 1990 by ten times.

In order to take advantage of a growing niche market for organic olive oil in Britain, developing country like Syria needs to overcome production and export constraints to have chance to export to UK, for example, Syrian organic olive oil producers should try to adapt and produce olive oil products and promote it based on different grades, flavours, colours, packaging …etc to meet consumers' needs in the UK market. The potential to improve promotion procedures and activities could be through creating companies which can work effectively in an emerging market to pass on simple and clear information about a new product offered in the market such as Syrian olive oil and its uses. Also, to promote an appropriate framework for organic olive oil standards and reduce the cost of quality certifications.

2.12 Summary

This chapter has examined the trends in the production, consumption and international trade in olive oil. The chapter also examined the key issues and challenges facing Syrian olive & olive oil sector and the opportunities for Syrian olive oil production (particularly organic olive oil) in relation to domestic and international markets with particular focus on export potentially to UK. The policies and measures of the Syrian government to encourage olive production and trade policies and reforms that could influence the potential for export of Syrian organic olive oil have also been examined. It is against the background of these trends in the international olive market and government policies that the potential for export of Syrian organic olive oil to the UK will be examined.

Chapter Three: Literature Review

3.1 Introduction

This chapter provides first empirical studies review of consumer behaviour theories influencing purchasing behaviour. Theoretical framework has been discussed in this chapter including: Consumer Behaviour Theory (CBT) and Random Utility Theory (RUT). Methodological review has discussed in the last section of chapter three.

3.2 Empirical Studies Review

In the last few years, olive oil sector has experienced significant growth in the world in producing countries as well as consuming countries. The largest producer of olive oil product around the world is the European Union (EU) which include the major players (Spain, Italy, Greece, Tunisia, Turkey and Syria) that produce around (80%) and consume (70%) of the total olive oil and account for 50% of world trade (European Commission, 2010). They shaped what is called the Mediterranean Diet[4] which includes olive oil as a main ingredient based on its health benefits. In recent years, the demand for olive oil in the UK alongside Germany has received more attention, especially in regards to issues of production, consumption and trade market as well as issues relating to health benefits, food safety concerns, the environment and genetically modified foods (de la Viesca *et al*., 2005). Also, the American market for olive oil has shown increasing trends in olive oil consumption, (Delgado and Guinard, 2011).

There has been a growing interest in matters of organic olive oil in the marketing literature, with special focus on consumers' perceptions towards the purchasing process. In order to better understand purchasing processes, it is useful to investigate consumer preferences based on a set of attribute level combinations. Steenkamp (1997) conceptual model of consumer behaviour and the factors which affect the purchase decision process, consisted of environmental factors (including economic, cultural and marketing aspects), personal factors (including biological, psychological and demographic) and the properties of food.

The Mintel Report (2000) reveals that the olive oil sector is worth some £104 million and alone accounts for an estimated 51% of the total market of olive oil in UK. Claire Birks, senior market analyst at Mintel marketing research company, explained that "although by volume standard

[4] Mediterranean Diet is a manner of eating based on traditional food or drinks of the countries around the Mediterranean Sea, it includes a high consumption of olive oil, high consumption of pulses unrefined cereals, fruits and vegetables, as well as moderate consumption of dairy products (mostly as cheese and yogurt), moderate to high consumption of fish, low consumption of meat and meat products, and moderate wine consumption.

oils still command the vast majority of the market, the fact that Brits now spend more on olive oil than on standard oils shows a willingness to pay a premium price for more sophisticated alternatives to everyday products. The use of olive oil in rustic and exotic dishes has also done a lot to elevate its status as something 'special' especially amongst those who enjoy recreational cooking and entertaining." (Mintel Report, 2000).

In Mintel's article entitled "Olive oil grows like greased lightning" published on Marketing Research World website in 2010, it showed that the number of British consumers buying virgin or extra virgin oil had risen from 25% in 2003 to 30% in 2009, with those purchasing regular olive oil remaining stable at 44% of consumers. Within the oils and fats market, sales of oils and fats by different categories (e.g. Butter, margarine, olive oil, vegetable and seed oil, …etc) have increased from 616.4 thousand tonnes in 2010 to 619.1 thousand tonnes in 2015. More specifically, for olive oil sales, it has increased from 28.6 thousand tonnes in 2010 to 31.5 thousand tonnes in 2015 (Euromonitor, 2015). However, the sales for olive oil in the UK market was £150.3 million in 2010 rising to reach £168.7 million in 2015 (Euromonitor, 2015). It can therefore be seen that there has been substantial growth in the UK olive oil market over the last few years. The consumption patterns of olive oil have changed and were initially driven by British consumers' concerns and awareness of health issues and nutrition in food, quality of olive oil and good quality taste and their willingness to reduce fat consumption in their meals and cooking.

Cues of the olive oil product (i.e. so-called signals as well) play a crucial role in consumer's preferences due to giving a degree of certainty of a selected product and helping consumers in making decisions. Cues of olive oil product can be divided into two categories, intrinsic characteristics related to the physical structure of the product such as taste, colour, flavour, organic or non-organic and grade of olive oil and the extrinsic characteristics related product characteristics such as price, packaging, country of origin and "fairtrade" etc. Egan *et al*., (2008) provided evidence on the validity of employing two intrinsic cues of wine products (body and sweetness) and two extrinsic attributes (price and country of origin) in a stated choice experiment. Results revealed that the utility of intrinsic cues is higher than that of extrinsic cues. Also, results showed that consumers retain information about their preferred sensory cues in memory

Tsakiridou *et al.*, (2006) present a study to examine factors which can affect consumer demand of organic olive oil such as socioeconomic characteristics, attitudes for buying organic olive oil, concerns towards food safety and environmental friendliness. They applied the Heckman approach in their estimations and their results indicated that the demand for organic olive oil is

influenced by socioeconomic characteristics. Demand for organic olive oil was positively related to high income and high occupational status (retired). However, younger respondents and lower educated people have a negative effect on the probability to purchase organic olive oil. Their results also pointed out that consumers paid more attention to food label and that the factors classified as significant positive factors are income, occupation status (employees) and concerns about healthy food in terms of including less chemical residues. However, male gender, young age and lower educated people have negative determinants.

Gil and Soler (2006) analysed the main determinants of consumers' knowledge and their WTP for organic virgin olive oil and their data set was collected in Spain in two cities. Their findings indicated that the main determinants of consumers' knowledge were socio-economic variables. They also found that consumers' attitude, lifestyle and knowledge influenced consumers' willingness to pay more for organic olive oil.

Scarpa and Giudice (2004) applied stated preference techniques to compare three samples in different cities in Italy; Naples, Rome, Milan. They aimed to investigate consumer preferences for extra virgin olive oil using multinomial logit models estimated from CE responses based on appearance, geographical origin, price and the certification (including organic) attributes. Their results indicated that the consumers' preferences for organic olive oil varied in different places and it was lower especially when moving from Milan to Naples.

Martínez *et al.,* (2002) showed that in spite of the fast growth in olive oil consumption in the UK, the culinary use of olive oil is relatively at an initial stage and new for consumers in the United Kingdom. British consumers considered a small number of attributes when purchasing olive oil while they considered more attributes when they were purchasing cooking oil. Their suggestion to increase the sales of olive oil and get more consumers to use it is to make olive oil visible to consumers in the market and make it competitive with other vegetable oils.

For food products, taste is considered to be one of the major attributes influencing consumer preferences. The sensory taste of olive oil can generally be established after consumption. Consumer perception of quality based on the taste of olive oil is an "experience" characteristic. Olive oil producers tend to identify the taste of olive oil based on sensory attributes such as bitterness, sweetness, fruitiness, pungency etc while on the consumption side, consumers appear prefer a quite plain, neutral taste of olive oil (Del Giudice *et al*., 2015).

Mtimet *et al.,* (2013) investigated consumer behaviour toward Tunisian olive oil. They used conjoint choice experiment technique based on different attributes of olive oil (taste, type, colour, packaging, region of origin and the price). They found that taste was a significant

determinant of consumer preference for olive oil with consumers preferring olive oil with a strong taste rather than a bland taste. Consumers also preferred extra virgin olive oil for their health and nutritional qualities. They preferred bottles with a quality label rather than bulk oils with no warranties concerning quality.

Bertuccioli and Monteleone (2014) identified two types of sensory attributes of olive oil. The first type of attributes are negative attributes – these represents sensory defects which should not be present in EVOO. These are attributes which have to be tested for as pre-requisite for labelling olive oil as EVOO. The second type of attributes are positive sensory attributes which include bitterness, pungency and fruitiness.

Caracciolo *et al.,* (2012), they reported in their study that consumers prefer olive oil with a neutral flavour without it being fruity, nutty or pungent. Cicia *et al.,* (2013) conducted a case study in Italy (Naples) with 68 different EVOOs which were evaluated by a panel of expert tasters to have a precise sensory profile from each sample the results have estimated in two equations models which highlighted the consumers preferences toward the trained experts preferences'. They found in their empirical study that respondents preferred olive oil with a bitter, fruity or pungent flavour to olive oil with a sweet flavour They also found that among different attributes present in their experiment, consumers paid attention to country of origin and whether the olive oil was organic or not.

The terminology for describing the sensory attributes of olive oil is problematic because taste and flavour are confounded. Kalua *et al*., (2007) point out that during the processing of olive fruits, there are some volatile compounds that contribute to a combined sensation of smell and taste of olive oil which consumers commonly refer to as flavour. However, Baiano *et al*., (2010) define the flavour of olive oil as a characteristic derived from being processed with vegetables, herbs, spices or any other fruit flavours for improving its sensory characteristics and nutrition value.

There are oils with several different types of flavours in the UK market - fruity (e.g. fruity with lemon or fruity with orange, or fruity with apple), nutty (e.g. nutty with almond, nutty with hazelnut), vegetable (e.g. with garlic, onion, chilli…etc.), herbs (e.g. with rosemary, basil, and fennel). In the UK, the olive oil market initially saw the introduction of oils such as spray oils, mild, light oils, seed oils and flavoured oils. Basil flavoured olive oil was dominant in the UK market with 60% of its total sales (Baiano *et al.,* 2010). Chili oil is in the second with 15% of its total sales then garlic oil with 10% of sales in the period of time between 2000 -2004. However, British consumers' preferences have changed over time with consumers becoming

more concerned about the health and safety dimensions of food products. Sales of olive oil products in the UK were estimated at £169.7 million in 2015 (Euromonitor, 2015), while vegetable and seed oil sales were £200.5 million in 2015.

Another intrinsic characteristic of olive oil is its colour. Olive oil has many different colours ranging from light yellow, dark yellow, yellowish, to green and dark green, which influence consumers' preferences along with taste. Sometimes the true colour of olive oil is concealed by the colour of the bottle in which it is sold. Gámbaro *et al.,* (2014) presented a study of olive oil in Uruguayan market in which five samples of virgin olive oil were assessed by 122 consumers in terms of colour acceptability and expected quality. Hierarchical cluster analysis was used to identify the consumer preferences and perceptions related to colour of virgin olive oil. They found that one cluster of consumers paid more attention to the green colour of oils which they described as rich in flavour, strong tasting and expensive. The second consumer cluster rejected the green colour of olive oil as they considered it to be of poorer quality. In the same study and without doing cluster analysis, most of the consumers considered that the yellowest colour of olive oil was identified as being cheap and poor quality.

In a US study by Recchia *et al.,* (2012) to investigate consumer preferences for EVOOs, four Italian branded EVOOs with different colours and perceived bitterness and pungency were selected for the study, two excellent quality olive oils brought from Italy for the purpose of the study and two other branded products brought from the supermarket. They found all consumers disliked deep green olive oil. Moyano *et al.,* (2010) pointed out that consumers can judge a product based on its external appearance such as colour and texture. Consumer avoid unusual colours of olive oil even when the other sensory attributes seem to be suitable.

Another intrinsic characteristic of olive oil product is the grade of the oil or type. EVOO is considered the common and the dominant type of oil in the market based on its degree of acidity. Chan-Halbrendt *et al.,* (2010) studied consumers' preferences in Albania, conjoint choice experiment was used to design the survey and their data was analysed using a latent class model. They estimated consumers' preferences for different attributes, grade of olive oil (extra virgin, virgin, and normal), origin (imported, domestic), the place of purchase (shop, supermarket), taste of oils (bitter, pungent) and the price of olive oil. Their findings showed that two clusters of consumers prefer extra virgin olive oil over other type of oils. Panico *et al.,* (2014) investigated Italian consumer preferences for EVOO. The data set was collected to be a representative panel of Italian consumers in 2011 and the sample size was 1054 respondents. The data obtained from the survey was analysed by using an econometric model to estimate consumer preferences and WTP for origin of olives. Their findings showed that many attributes

can affect consumer preferences for choosing olive oil products such as origin certification (PDO or PGI, organic, no certification), production methods, taste of olive oil (fruity, sweet, pungent), also they found consumers showed a willingness to pay more for organic and country of origin information on the label.

Packaging and storage of olive oil are important attributes in terms of keeping food safe and healthy. Several factors can affect olive oil shelf life starting from olive quality to processing techniques and storage. To maximize shelf life stability, the material used for packaging should prevent light and air penetration according to Wang Selina *et al.,* (2014). They summarized in their report the commercial packaging for olive oil into different categories such as aluminium, stainless steel, glass, plastic…etc with pros and cons for each packaging category. Pristouri *et al.,* (2010) studied the effect of packaging parameters (i.e. transmission of light and oxygen, headspace volume) and storage temperature on quality of EVOO. Packaging materials tested include different types of packaging; transparent glass was one of these types. They found from their experiments that the most appropriate packaging material for EVOO is a dark coloured glass container. It was also preferable to store EVOO at a temperature equal or less than 22ºC if the shelf life is to be six months.

Del Giudice *et al.,* (2015) reviewed the most important attributes of EVOO for consumers using a meta-analysis of stated preferences studies. They found that the most investigated EVOO attributes include intrinsic attributes such as taste, appearance and colour, and extrinsic attributes such as packaging, logo certifications, brand name of the product. However, Piscopo and Poiana (2012) considered that packaging and storage of olive oil was important. Consumer's judge olive oil quality not only based on sensory attributes such as taste of olive oil, flavour, but also based on extrinsic attributes such as packaging materials. Incorrect packaging and storage containers can influence the sensory characteristics of olive oil quality and make it rancid and off-flavoured (Piscopo and Poiana, 2012). Piscopo and Poiana also mention that Italian consumers prefer the olive oil in glass containers with different shapes and capacities and different colours of bottles (i.e. white, green, darker green).

Duquenne and Vlontzos (2012) studied the relationship between socio-economics categories (e.g. age, education level, household's size, income, etc) and consumers' preferences of olive oil attributes such as price, packaging and environmental protection. They found that age and education levels are the most influential factors affecting the purchasing behaviour of Greek consumers. Household size and family income were not significant in influencing consumers' purchases. 66.4% of consumers were also willing to pay a price premium for organic olive oil, while 30.9% of consumers were willing to pay more for certification protocol.

Price of EVOO is considered the most important attribute which can influence consumers in their buying decisions. Several studies have focused on the price attribute and its relationship with other attributes of olive oil. Carlucci *et al.,* (2014) analysed the relationship between the price of EVOO and its main quality attributes (packaging size, container size, production methods and extraction methods). A survey was performed in Italy in 2012 with 169 virtual stores of small and medium-sized enterprises which were interested in online selling of EVOO. A data set of 667 references was used to estimate the implicit prices of considered attributes. They found that most of these attributes are strongly and significantly affected the price of EVOO. Some other studies have also highlighted the price attribute as an important indicator for high quality of EVOO (Cicia *et al.*, 2002, Giudice, 2004).

It is common to notice that consumers have a tendency to believe that higher quality products are more expensive and vice versa (Kardes *et al.,* 2004). However, Bredahl (2004) found that the price of the beef products was not a significant quality cue because Danish beef market was very price competitive, varieties of chilled beef were sold at a discount and experienced consumers could find high quality beef at a cheap price. Veale *et al.,* (2006) studied consumer behaviour examining how intrinsic and extrinsic cues are used in evaluating food products. They focused on two extrinsic cues which are country of origin and price of product and how those cues can influence product quality before and after the purchasing process. Their research design included two focus groups conducted to ascertain Australian consumers' belief about CoO and price attributes. They applied conjoint analysis to measure the influence of product cues on the expectations of the product quality. Their results suggested that the CoO and price attributes influence consumers' assessment of product quality in the case of wine and cheese products. Martínez *et al.,* (2002) found that price of standard olive oil is the most significant attribute influencing consumers' purchases. The size of the container can affect consumer choice by through selection of smaller packs rather than large ones. They also found that glass or plastic packaging is not a significant attribute for British consumers.

Brijball (2003) studied the relationship between the price and quality of food products. Data from 237 Indian consumers was used this study. The results suggest that consumers often judge the product quality based on many attributes associated with the product. Price and quality were seen as having a one to one relationship in a quarter of the sample.

Fairtrade attribute is an important attribute in consumers' selection of olive oil. The aim of the Fairtrade logo is to help in raising incomes of farmers in developing countries. The Fairtrade logo is applied to many products such as coffee products, tea, chocolate, olive oils. Consumers buy Fairtrade products to support farmers in developing countries or to show solidarity and

sympathy to people facing humanitarian or other crisis (e.g., Syria or Palestine). Meneley (2011) examined the Fairtrade EVOO from its troubled production in Palestine to its difficult circulation in Israel to consumers who showed solidarity to buy Palestinian olive oil. This is consistent with a survey conducted in the United States by Loureiro and Lotade (2005) who found that respondents were very receptive to the Fairtrade coffee label and were willing to pay ($0.22) more for Fairtrade coffee. Another empirical study was conducted by (Hiscox *et al.*, 2011) about the consumer demand for Fairtrade products. Their experiment conducted between 2007 -2009 on eBay website to examine consumer demand for the Fairtrade label. They found that on average people paid a 23% premium for coffee labelled Fairtrade.

Country of Origin (CoO) has been defined in different ways in marketing research studies. It can be considered the source country of a product. Erraach *et al.*, (2014) assessed Spanish consumers' preferences for PDO[5] labelled extra virgin olive oil along with other attributes such as price, packaging, and colour. They analysed the market potential of the European PDO label in Spain. Conjoint analysis was used to estimate consumes' preferences of olive oil. 439 consumers completed a survey through face to face interviews in Andalusia city in Spain. Cluster analysis was used to segment consumers. They found that price and PDO origin label were the most important attributes that influenced Spanish consumers of olive oil. Two clusters out of four showed concern about the PDO label.

Mtimet *et al.*, (2011) examined how additional information related to country of origin might affect the perception of Japanese consumers to choose Tunisian olive oil. A total sample of 534 persons responded to the survey conducted by the NTT Resonant Inc. which provides Internet research services in Japan. They used a choice experiment with four attributes of olive oil including CoO, type of olive oil, price for 500ml olive oil bottle, and taste. Their results pointed out that consumers' evaluation differ significantly for all attributes based on providing additional information or not. In terms of country of origin, the impact of providing additional information makes consumers showed concerns about country of origin, their evaluations were highest for Italian olive oil, followed by Spanish olive oil then the Tunisian oil. However, for

[5] The European commission has developed the label presented on the market in terms of the origin label; *Protected Designation of Origin (PDO)* identifies products where are produced, processed and prepared in a specific geographical area using the recognised know-how of local producers and ingredients from the region concerned. And products have a PDO logo on the label such as: Bordeaux (France, wine), Cava (Spain, wine), and Pistacchio verde di Bronte (Italy, fruit) (*http://ec.europa.eu/agriculture/quality/*).
Protected Geographical Indication (PGI) identifies products whose quality or reputation is linked to the origin where it is produced, processed or prepared, the ingredients are not necessary to come from the same geographical area. Products have a different logo on the label. Examples, Liliputas PGI (Lithuania, cheese), Walbecker Spargel PGI (Germany, vegetable) (*http://ec.europa.eu/agriculture/quality/*).

other attributes such as type of oil, Japanese people prefer extra virgin olive oil. Fruity taste was significant and the most preferred choice.

Scarpa and Giudice (2004) examined Italian preferences for olive oil. Using stated preference techniques, they compared three samples of urban consumers of EVOO in three cities in Italy: Naples, Rome and Milan. Consumers' preferences were estimated using multinomial logit models from CE data set. The sample size was 300 respondents including consumers of EVOO. Four attributes used in CE were appearance (Turbid, Limpid), certification (PDO/PGI, organic, no certification), price (€4.00, €6.00, €7.50) and geographic origin (north centre, south, unknown origin). They found that a strong heterogeneity exists in Italian consumers' preferences in terms of product origin matters. The significance of organic certification and PDO/ PGI were also varying across those three cities.

Ward *et al.,* (2003) found that consumer preferences for olive oil based on country of origin are different in Germany. The probability of buying olive oil based on country of origin can be influenced by many factors such as demographic distribution, attributes of olive oil product and information sources of olive oil (e.g. television, newspapers). They used multinomial model to investigate the preferences of the Germany population of olive oil based on different country of origin, demographics characteristics, attributes of the product and the sources of information. Results showed that all these factors were statistically significant impacts on the probability of using each source.

3.3 Theoretical Framework

The main theories that underpin empirical choice modelling within Economics are Lancastrian Consumer Behaviour Theory (CBT) and Random Utility Theory (RUT). The following section outlines these two theories.

3.3.1 Consumer Behaviour Theory (CBT)

Consumer decision making has occupied an important role in economists' research, beginning with Nicholas Bernoulli, John von Neumann and Oskar Morgenstern who studied the basis of consumer decision making (Richarme, 2007) as well as the act of purchase (Loudon and Dellabitta, 1993) through the context of economic perspectives. The most prevailing model which has emerged from this perspective is the "utility theory". Utility theory suggests that consumers make their choice based on the expected utility of their decisions. At the point that consumers are displayed as rational decision makers who are concerned with self- interest (Schiffman *et al.,* 2008) and the utility theory views the consumer as a "rational economic man" (Zinkhan, 1992); several studies have been conducted on consumer behaviour area which take

into consideration factors which influence the consumer, also activities beyond the purchase process. Some of these activities cover: information search about products, evaluating other options and alternatives that are available in the market, and the intention of the purchase process.

Recently, in the present marketing scenario, research of consumer behaviour has become essential. Consumers play a crucial role in the market, where all activities are concerned finally with the consumers and their satisfaction. Most studies of consumer behaviour have evolved in the light of applying new research methodology and adopting different paradigms of consumer research perspectives.

During the 1960s, the consumer behaviour theory has emerged as a remarkable field to be argued in different ways. Two paradigms of consumer behaviour are characterized under "positivist" and "non-positivist" according to Pachauri (2001). The positivist paradigm includes many subjects such as economic, behavioural, and cognitive and marketing. This paradigm is based on utility theory and its benefits from the consumption process. Positivist paradigm can be considered the traditional perspective and as a starting point to the second paradigm. However, the "non-positivist" paradigm covers more recent period of time, post 1980s. It concerns the rational view and homogenous social culture. The objective of this perspective is to get a better understanding of consumer behaviour without any influence on the consumer process in choosing the preferred choice. Simon (1955) mentioned that some specific assumptions of the rational choice models are introduced as an obstacle in getting the rational calculation such as, how many options are open to choose, the relationships that determine the pay-offs ("satisfactions", "goal attainment") as a function of the alternative that is chosen, and the ordering preferences though the pay-off process. In the standard view, Levin and Milgrom (2004) defined that the rational choice is the process of determining how many options are available to individuals then selecting the most preferred one under some consistent criterion. More specifically, the rational choice model is an optimization choice under a certain approach.

Links between the consumer behaviour theory and consumer choice modelling have found different assumptions. First, the assumption of the consumer theory is considered products and goods to be homogeneous; it means the utility evaluation of a product is only as a quantity (unit) without consider the characteristic of the product. For example, the individual considers a car as a car which means the evaluation of the utility is only as a quantity (as a unit) not as an attribute of that unit. While Lancaster (1966) introduced the main idea of consumer demand of product; the demand for the product is not only by choosing between two goods but also by

choosing between different attributes and characteristics of the products provided. Second, the substantial concept of Random Utility Maximization (RUM) has been developed by some researches such as Thurstone (1927) and developed further by (Marschak, 1960; Luce, 2005; Manski, 1977); they provide the most common theoretical framework of discrete choice models. In addition, (McFadden 1973; Manski and McFadden, 1981) point out that the strong interaction between statistical models of observed choices and economic models of utility maximization have been employed by applying the RUM hypothesis. The deterministic behaviour has been introduced in classic consumer behaviour theory while the random utility theory informs that the individual consumer behaviour is essentially probabilistic behaviour. In the context of RUT, many attempts are tested to shed light on the area where individuals, in their thoughts, have an indirect picture of the utility of other choice alternatives and they may have perfect discrimination ability. The assumption here is to achieve the utility maximization of consumer[6] choice, s/he as a consumer should have a full knowledge of all factors determining preferences. This in its turn implies that consumers should have a level of certainty of preference choice. However, some information of preferences are incomplete by the researcher's knowledge, therefore, the level of uncertainty must be taken into consideration (Hanemann, 1984). In this respect, the utility function is modelled as a random function which includes two elements: the first one is the measurable element which can be considered as an observable elements, and the second element is the unobservable or random component (error term). Manski (1977) identified different sources of uncertain elements such as: error term in utility function, random alternative attributes, unobserved individual characteristics (i.e. unobservable taste variations) and finally the proxy variables.

Domanski and Von Haefen (2010) mentioned that the treatment of unobserved determinants of choice as random draws from a distribution which will make the probabilities for each alternative to be estimated based on one of the varieties of likelihood-based inference methods.

Third, in the context of consumer theory, it deals with continuous goods (i.e., infinitely divisible). Therefore, a continuous space of options (alternatives) is required. However, in terms of the discrete choice theory, it deals with a choice of a finite set, and taking into account that the options in the choice set are mutually exclusive (i.e. choosing one option necessarily implies avoiding any other options to be chosen (Train, 2003)). The random utility hypothesis stays intact using different kinds of techniques (Walker, 2001). In this sense, the discrete choice modelling relies on the random utility theory and can be considered the best standard technique of individual choice behaviour.

[6] In terminology, "Consumer" is the same of "Individual" is the same of "Respondent".

In consumer choice theory, the most valuable question is about how the consumer makes the "trade-off" between alternatives when making a purchase decision. Typically, a consumer faces two or more alternative choices, the alternatives introduce a degree of conflict (Bravo *et al.*, 2012), and the choice itself contains an extensive cognitive process aimed at minimizing this conflict (Hansen, 1976). In the scenario of consumer choice, the consumers try to maximize their final decision by maximizing the decision accuracy of their purchase process and minimizing the effort in getting their goals (Bettman *et al.*, 1998).

Bravo *et al.*, (2012) pointed out that different perspectives contributed in building the consumer choice theory, comprising; *Rational Choice Models* (e.g. random utility theory and prospect theory) which are typically connected to decision problems in economic terms, the choice in these models is defined as the "maximation of value" (Shafir *et al.*, 1993), and the choice might be influenced by a set of particular product attributes; these attributes can be valued with the utility assessment. The assumption that consumers have the ability to evaluate the utility for each preference, obtain a combined utility and then compare and evaluate this combined utility with other utilities before making a decision about the choice that give him/her the highest value. *Information Processing Models* (e.g. multiattribute attitude theory), Bravo *et al.*, (2012) viewed that the information processing models explained how the choice is restricted by the bounded rationality concept (Simon, 1955). In this respect, decision makers have a limited ability to process and evaluate the incomplete information for their choice. Then, the decisions are affected by many factors such as the perceptions and attitudes rather than the utility assessment. Therefore, Bettman *et al.*, (1998) mentioned that the choice grows to be a process of construction rather than only a process of determining and selecting product attributes that already exist. In this consideration, choice happens as a behaviour in response to a decision-making problem. All problems are affected by complex cognitive processes which include perceptions, attitudes, behavioural intentions, and preferences toward the product (McFadden, 1986). *Reason- Based Choice Models* (e.g. used in law and political sciences explaining choice in terms of balance of reasons for and against different available options) (Bettman *et al.*, 1998; Shafir *et al.*, 1993).

Thompson (1998) considered that each consumer maximizes the utility function that represents personal preference by taking into his or her consideration the commodities' prices, income and other socioeconomic factors.

Contemporary research on consumer behaviour has continued to study more factors and activities that influence consumer decision. (Solomon, 2006) have summarized this in their following definition of consumer behaviour: "Consumer behaviour… is the study of the

processes involved when individuals or groups select, purchase, use or dispose of products, services, ideas or experiences to satisfy needs and desires." (p.6)

3.3.2 Random Utility Theory (RUT)

Random Utility Theory (henceforth, RUT) is a well-established method for describing discrete choice behaviour. It describes consumers' preferences among alternatives and these preferences will identify consumers' choices observed in experimental approaches (Ben-Akiva and Lerman, 1985). In utility theory, utility is an abstract measurement of the degree of want-achievement provided by the product. It is difficult to measure utility of the product gain by the person directly, however, individual's behaviour can help to make inferences about the utility. Individuals in their thoughts are believed that they have indirect utilities of other alternatives existed in goods or services and they may have ideal discrimination capability between choices, RUT assumption is considered that the individual maximizes the utility of his/her choice if s/he has fully knowledge of factors determining the preferences and has level of certainty of preference choice. However, the analysts consider that the lack of available information about the product can add a level of uncertainty (i.e. represents a random variable in utility model); the treatment and implications of uncertainty affect some of product attributes but not all. For example, in our study, the price attribute is considered known with certainty by the respondent while the taste of olive oil attribute is uncertain. Baltas and Doyle (2001) considered that the utility maximization is the main intention of the decision process which directs to observed choice in such a manner that the consumer selects the most preferred alternative where the utility is maximal. The analyst cannot observe all the factors affecting the preferences, therefore, RU model uses stochastic assumptions to explain unobserved variation in preferences. A very practical way to allow for preference maximization is to reflect the utility function in two parts:

1. A deterministic component (or non-stochastic) which is specified as a function of measured attributes of the alternatives and/or the individual, and typically consists of fixed coefficients across an individual.
2. A stochastic component represents unobserved attributes affecting choice, individual differences in utilities depending upon the heterogeneity in tastes, measurement errors, and functional misspecification (Manski, 1977). In recent years, in acknowledgment of what (Train, 2003) has done to choice models that giving more flexibility to regression functions parameters to vary across the individuals in some systematic way, showing that in different distributions of preferences.

Train (2003) offered the following explanation for the two main components of RU: "It is important to note, however, that models derived from utility maximization can also be used to represent decision making that does not entail utility maximization. The derivation assures that the model is consistent with utility maximization; it does not preclude the model from being consistent with other forms of behaviour. The models can also be seen as simply describing the relation of explanatory variables to the outcome of a choice, without reference to exactly how the choice is made"

Louviere (2004) reviewed RUT based on stated preference elicitation methods. He considered that the RUT gives a behavioural theoretic basis for several applications related to the preference elicitation procedures, the RUT also provides the basis of discrete choice experiments (e.g., (Louviere and Woodworth, 1983)) and non- experiment forms. Moreover, RUT delivers an elegant context to formulate and test a wide variety of statistical preference models such as a probabilistic discrete choice models. Stewart and Kahn (2006) mentioned that the output of random utility model gives an estimation of an individual probability of selecting a policy alternative depend on its attributes. This can help in determining a crucial policy for competing alternatives and can achieve the maximum utility for the individual.

All notations in this section are adaptation from (Train, 2003; Ryan and Gerard, 2008). To explain the random utility model, it is assumed that each individual (n), (*where* $n= 1, \ldots, N$ is faced with a choice among (J) alternatives (j=1……..J) which are mutually exclusive from a choice set C_n ($C_n = 1,2,3,\ldots..M$) which is exhaustive, in time period t ($t= 1, \ldots, T$), and the order of the all alternatives would not influence the individuals' choice processes. The utility that the individual decision maker (n) selects from alternative (j) in a period of time t is (U_{njt}) known by the individual decision maker but clearly not observed by the analyst (i.e. researcher) or anyone else. The individual gets a certain level of utility from each alternative (j), choosing alternative (i) which maximises his (her) utility if and only if:

$U_{nit} > U_{njt} \quad \forall j \neq i$ where $i, j \in C_n$. Aforementioned earlier that the analyst does not observe all factors affecting preferences. The latent utility U_{nit} of an alternative (i) in the choice set C_n as is observed by individual decision maker (n) is divided into two components; the first part is an observable deterministic component: $V_{nit} = V(X_{nit}, \beta_n)$ where X_{nit} is a k-dimensional vector representing the determinants of choice such as, attributes of product, demographic characteristics (e.g. gender, age, education. etc), and also include any interactions of these characteristics that are observed by the analyst as well as preference parameters (β_n). Actually, the analyst should devote enough time and resources to collecting the data and should include the key influences on choice in the experiment, the data could be primary qualitative (e.g. Focus

group discussion or interviews) or could be secondary data resource (e.g. previous literature review, other experience or experiments on the same product) or could be a mix between both primary and secondary resources. The second part is an unobservable, a stochastic random error component ($\boldsymbol{\varepsilon}_{nit}$) representing unmeasured variation in tastes/ preferences, which may be caused by unobserved attributes affecting choice, inter-individual variations in utilities based on heterogeneity in tastes, measurement error and/ or functional misspecification (Manski, 1977). The equation is written in the form[7]:

$$U_{nit} = V\,(X_{nit},\, \beta_n) + \varepsilon_{nit} \tag{3.1}$$

Where $V\,(X_{nit},\, \beta_n)$ is a deterministic component and is considered linear in parameter function form (Louviere *et al.*, 2000; Louviere and Woodworth, 1983; Manski, 1977).

ε_{nit} is the error term of utility function. The main assumption to the logit model is that the error term is *iid* (i.e. Independently and Identically Distributed) extreme value or also called Gumbel or extreme value type I.

β_n is a vector of coefficients represent " Partworths", " Marginal Utilities"," Taste Weights".

Obviously, the central assumption in RUT is that the individual decision maker (n) will select an alternative (i) if and only if this alternative can maximize her/his utility among all (j) alternatives in the choice set (C_n). And the choice symbol y_{nit} is equal one if alternative (i) is selected and zero if otherwise and it as following:

$$y_{nit} = \begin{cases} 1\ if\ U_{nit} = \max\{U_{ij}\} \\ \qquad\qquad\qquad \forall\, j \neq i \\ 0\ otherwise \end{cases} \tag{3.2}$$

The utility for the individual decision maker who choose *(i)* alternative over other alternatives *(j)* as following:

$$(V_{nit} + \varepsilon_{nit}) > (V_{njt} + \varepsilon_{njt}) \qquad \forall j \neq i \tag{3.3}$$

Reorganising equation (3.3) to state the observable components in one side and the unobservable components on the other side, we be as following:

$$(V_{nit} - V_{njt}) > (\varepsilon_{njt} - \varepsilon_{nit}) \qquad \forall j \neq i \tag{3.4}$$

The statement in (3.4) is quite difficult to determine and the error term is not observed. Thus, the choice output can be viewed as a probability of occurrence. The probability of individual

[7] Baltas and Doyle (2001) pointed out that the latent utility in equation (4.1) introduce uncertainty regarding the choice. The probability of the choice is not only included to reflect the choice behaviour, but also to describe the lack of the information through the random error term. As a result, the utility function is treated as a probabilistic approach.

(*n*) who chooses the alternative (*i*) which is reflected by attributes X_{nit} is equal to the probability that the difference between the two random utilities [alternative *(j)* and the chosen alternative *(i)*] is less than the difference between the two deterministic utilities levels of alternatives *(j)* and *(i)*, for all *J* alternatives in C_n (McFadden, 1974)[8]. And it is given by:

$$P_{nit} = Prob\ (y_{nit} = 1 | x_{nit}, \beta_n)$$

$$= Prob\ (U_{nit} > U_{njt}) \qquad \forall j \neq i$$

$$= Prob\ (V_{nit} + \varepsilon_{nit} > V_{njt} + \varepsilon_{njt}) \qquad \forall j \neq i$$

$$= Prob\ (\varepsilon_{njt} - \varepsilon_{nit} < V_{nit} - V_{njt}) \qquad \forall j \neq i \qquad (3.5)$$

Where defining the error term as $\varepsilon_n = \varepsilon_{njt} - \varepsilon_{nit}$ and to solve equation (3.5) the analyst must impose a probability density function on ε_{ij}. In fact, each type of probability distribution imposed on ε_{ij} gives a different discrete choice model (e.g. probit model with normal distribution of error term, mixed logit model with Gumbel distribution of error term and so on).

P_{nit} can be stated as a cumulative probability as written:

$$P_{nit} = \int_{\varepsilon} I\ (\varepsilon_{njt} - \varepsilon_{nit} < V_{nit} - V_{njt}\ \ \forall j \neq i)\ f\ (\varepsilon_n)\ d\ \varepsilon_n, \qquad (3.6)$$

Where *I (.)* is the indicator function, which is equal one when the term in brackets is true and zero otherwise (accept or reject). ε_n is unobserved error term, different assumptions imposed of the distribution of the error term result in different categories of discrete choice models. Many factors can impact on the distribution of error term such as measurement errors, delete essential attribute cannot be measured and/ or unknown from the utility function.

The equation in (3.6) is multidimensional integral over the density of the unobserved portion of utility $f\ (\varepsilon_n)$. Different assumptions of the density distribution will achieve different discrete choice models. For example, probit model is derived under the assumption that the density function *f (.)* is normal distribution. Train, (2003) mentioned that the density function, $f\ (\varepsilon_n)$, can be considered in three different approaches; the first approach, $f\ (\varepsilon_n)$ is the distribution of the unobserved random component of utility within the population of individuals who have the same observed utility for each alternative as individual decision maker *n*. according to that, the probability (P_{nit}) reflects the proportion of individuals within the population who select

[8] McFadden, (1974) and (Hanemann and Kanninen, 1999) the central assumption of the RUT is based on the idea that individuals act rationally, choosing the alternation that produces the highest utility. Consequently, the probability of selecting a given alternative will be higher if the utility provided by such alternative is the highest among the different choices.

alternative *(i).* Second approach, $f(\varepsilon_n)$ is the distribution that representing the researcher's subjective probability that the individual's unobserved utility will take given value as well, according to that, the probability (P_{nit}) is assigned to each individual by the researcher. Third approach, $f(\varepsilon_n)$ is the distribution that reflecting the effect of unobserved factors that are inherent to the individual decision maker (s/he) such as aspects of bounded rationality, as a result of that, the probability (P_{nit}) is the person's choice of alternative *(i)* given the observed factors. In conclusion, Ben-Akiva and Bierlaire (1999) considered that random utility models assume, as does the economic consumer theory, that the individual decision maker has a complete discrimination capacity. However, the researcher is assumed that there is a lack of available information, therefore, the uncertainty must be taken into consideration.

3.4 Methodological Review

Choice Experiment (CE) techniques have been widely used by researchers in different disciplines such as transportation (Ben-Akiva and Lerman, 1985; Hensher et al., 2005b), health economics (de Bekker-Grob *et al.*, 2012; Ryan *et al.*, 2007), environmental economics (Carlsson and Martinsson, 2001; Adamowicz *et al.*, 1998; Hanley *et al.*, 1998), food quality and marketing (Grunert, 2002; Loureiro and Umberger, 2007; Gracia *et al.*, 2009; Balcombe *et al.*, 2015). CE is theoretically based on, first, Lancaster's theory of consumer preferences (Lancaster, 1966). Lancaster defined consumer preferences for a product are based on the utility derived from its individual characteristics. Second, Random Utility Theory (RUT) is considered the fundamental cornerstone of choice modelling technique as it was developed by (Luce, 1959; McFadden, 1973). This theory allows researchers to analyse CE data through different statistical models like multinomial logit, probit, mixed logit, also, it allows analysts and researchers to include price attribute to estimate marginal utility of attributes and estimate willingness to pay (WTP). Qualitative research methods have been used widely prior to CE application. There are many methods to elicit consumers' preferences such as Focus Group Discussion (FGD), one to one interviews, in-depth interviews and Verbal Protocol Analysis (VPA).

In marketing research, focus group discussions (FGDs) are considered an effective approach to elicit consumers' views, ideas, beliefs and opinions. It is used widely in consumers' research. FGDs provide rich data if conducted properly. Morgan (1997) found that conducting a group discussion allows people to interact to produce data related to their perspectives, ideas, thoughts, beliefs and different opinions. Kitzinger (1994) highlighted ten advantages to be gained from conducting FG discussions. The advantages are that FGDs provide respondents' opinions, beliefs, language and framework of understanding. It also stimulates a variety of

communication and interaction between people who participate in the discussion. Denise Threlfall (1999) mentioned that in marketing applications, researchers should use more than one data gathering technique. Results collected from FGDs alone will not entirely provide the natural viewpoints of participants. However, FGDs could be a useful method in initial stages of research or to validate the perspectives of the participants on a specific topic or to evaluate a new product in the market.

For the purpose of this study, it was quite useful to conduct a focus group discussion to determine which attributes of olive oil product should be included in choice sets and how many attributes be used in CE application, and also in eliciting the levels for each attribute used in the CE. These inputs were useful in the design of the CE. The main purpose of the FGD was the appropriate selection of the attributes and their levels for olive oil product to be analysed later on. Hair (2009) noted that each attribute is a product characteristic and it has a salient influence in the choice of the consumer through the buying process. Green and Srinivasan (1990) refer to the level of an attribute as a specific value which differs from person to person, based on individual preferences. Churchill and Iacobucci (2005) mentioned that based on FGDs, they selected the most important attributes to use in a conjoint analysis application. They also used inputs from FGDs to exclude some of the attributes that were not relevant to their study. Davies and Laing (2002) described the contribution of FGDs in designing a choice experiment in an urban environment. Four focus groups were conducted in Aberdeen to identify changes to the urban environment that the public would like to see take place; first, in terms of redefining the use of an area, and second, in terms of the attributes that could be placed within the redevelopment scene.

Morrison *et al.,* (1997) reported an overview of designing choice modelling surveys using eight focus groups discussions. They used focus group discussion to develop choice modelling survey in an environmental case study. They found that focus groups delivered insight information which were relevant to include in the survey about the respondents' preferences regrading to the wetland. The focus group discussion helped also to refine the draft of the questionnaires and reduced some issues related to "bias, confusion, implausibility and indicator attributes" which can be found in the survey. In a similar way, Rolfe *et al.,* (2004) presented a report which included a design of choice experiment to investigate Landholders' preference heterogeneity in willingness to accept direct monetary incentives for riparian buffers in the Fitzroy Basin in central Queensland, they used FGDs as a useful tool to determine the relevant attributes and their levels and the status quo and all alternative options used in the choice modelling technique, this technique was applied to environmental valuation issues.

Martínez *et al.,* (2002) conducted FGDs for understanding British consumer behaviour in relation to standard olive oil. The two main findings from the FGD were (1) the vast majority of British consumers prefer a local product except on some occasions when they choose famous brands (e.g., Italian brands). (2) The participants show a high preference for extra virgin olive oil regarding it as the virgin oil with the highest quality. Three attributes are considered as principal determinants guiding British consumers in making a purchase decision packaging, price and the size of the bottle.

Good examples of FGDs are provided by Nelson and Towiss (1999) to determine realistic environmental attributes that can be included in a choice experiment design to value the environmental impact of a transportation scheme. Mariampolski (2001) refers to the advantage of FGDs by allowing interactions between different participants and the researcher to investigate some patterns for a specific product or communication.

Along with FGDs, verbal protocol analysis (VPA) is also considered a useful qualitative method for eliciting consumer preferences for products. VPA can elicit information about how consumers perceive different attributes of a product, which can inform the design of CEs. VPA involves transcription of participants' speech recorded by the researcher while they carry out a task under instructions and think out aloud. VPA method has emerged as one of the best qualitative methods for studying cognitive processes in psychology (Crutcher, 1994), cognitive science (Simon and Kaplan, 1989), and in behaviour analysis (Austin and Delaney, 1998). Also, several adaptations of VPA have been used by researchers in the context of education (Renkl, 1997), study of text comprehension (Pressley and Afflerbach, 1995) in consumer judgment and decision making processes (Bettman and Park, 1980; Bettman, 1979; Biehal and Chakravarti, 1982a; Biehal and Chakravarti, 1982b; Biehal and Chakravarti, 1986; Biehal and Chakravarti, 1989; Green, 1995; Kuusela *et al.*, 1998).

A body of literature has developed practical guidelines for successful implementation of VPA procedures. In an in-depth review of VPA, Ericsson and Simon, (1993) point out that what participants think out aloud reflects the content of their short term memory and can be used for analysing the cognitive process of participants performing the given task. Ericsson and Simon provide evidence that the process of thinking out aloud does not affect the performance of the task or the sequence in which different elements of the task are performed. Ericsson and Simon provide comparison case studies between participants who perform the task while thinking aloud and the participants who perform the task silently.

Newell and Simon (1972) defined the VPA as a method that facilitates the training of the subject (i.e. human), the participant, in verbalizing his/ her thoughts in order to deal with the issue in hand through cognitive processing. Montgomery (1976) provided an example of how verbal protocols can also be used to test specific hypotheses about behaviour in experimental settings. (Ericsson and Simon, 1980; Ericsson and Simon, 1984), with their work, especially in the context of psychology research studies, provided valuable information in terms of how VPA deals with problem solving, mathematics and decision making. They used VPA to get better understanding of human behaviour in terms of solving simple and complex problems.

To date, several researchers have used VPA not only in the context of psychology and marketing research but also for the study of language-related academic tasks (Vaughan, 1992; Connor and Carrell, 1993), and they refer to this technique as "verbal reports" or "think-aloud" (Bowles and Leow, 2005; Leow and Morgan-Short, 2004; Rosa and O'Neill, 1999) where the participants think out loud during completing the task. Pressley and Afflerbach (1995) distinguish between two forms of verbal protocol - the concurrent protocol and the retrospective (or introspective) protocol. In their review of concurrent and retrospective protocols, Ericsson and Simon (1993) discuss a number of factors that can affect both protocols. For instance, difficulties and problems faced by a researcher in getting all thoughts from the participants when they are under time pressure to complete the task, or difficulties in recalling all thoughts, or the effect of the concurrent protocol on the retrospective one.

In the field of choice experiment, stated preference technique is used based on the assumption of economic rationality and maximum utility. This technique allows researchers to cover how consumers evaluate the different attributes of products in marketing research. In stated preference technique, respondents will be asked to choose (or rank or rate) between different hypothetical scenarios presented in choice sets. Respondents' choices can be used to evaluate and give inferences how consumers value the attributes of the product. In fact, stated preference technique is used to evaluate a product that does not exist yet in the market or when the actual observed revealed preferences are not available to consumers.

Discrete choice experiment technique is broadly used to elicit consumers' preferences and attitudes in consumer behaviour and marketing research. Generally, the "continuity axiom" is considered the basic assumption of discrete choice experiment which typically assumes that respondents choose their preferred choice by considering all attributes presented in a choice card, making trade-offs between all attributes (that is, gains in one attribute being offset by losses in another). However, empirical evidence has been demonstrated by (Ryan *et al.*, 2009; Hensher and Greene, 2010) that respondents make choices based on information processing

strategies. One of these strategies is for respondents to not consider all attributes in making a decision, in other words, to ignore one or more attributes when making a trade–offs between attributes which is called Attribute Non-Attendance (AN-A). AN-A means that respondents make their choices relying only on a limited set of attributes, breaking the assumption of "continuity axiom" in choice experiments. It is important to consider AN-A in choice experiments as failure in accounting for AN-A may give poor model performance and bias WTP estimation.

In CE, there are two approaches to deal with Attribute Non-Attendance; the first approach is called Stated Non-Attendance (SN-A) which depends on directly asking the respondents about which attributes they ignored in making their choices (Balcombe *et al.,* 2011; Hensher *et al.,* 2005a; Carlsson *et al.,* 2010). The second approach to dealing with AN-A is called the Inferred Non-Attendance (IN-A). in IN-A an analytical model is used to identify non-attendance rather than asking the respondents about the attributes that they ignored (Scarpa *et al.,* 2009; Campbell, 2008). In the present study, the SN-A approach was used in online survey questionnaire and respondents were directly asked to identify the attributes which they ignored.

Balcombe *et al.,* (2011) found that it was useful to ask the respondents directly whether they ignored attributes when making their choices in the DCE survey. Several studies have found that respondents in CEs may not consider the whole set of attributes and levels of attributes; respondent choice may depend on a selection of attributes (Hensher, 2006). The implication of the AN-A concept is that respondents may not make trade-offs between all the attributes presented in making their choices. Attributes ignored by respondents in decision making can be identified through supplementary questions in the survey. The AN-A questions ask the respondent to state which attributes have been ignored when choosing their preferred options (Campbell *et al.,* 2008; Hensher *et al.,* 2005a; Rose *et al.,* 2005).

AN-A does not mean that the respondents may not weigh up all attributes or not care about what they ignored. (Hanley *et al.*, 2001; DeShazo and Fermo, 2002; Scheibehenne *et al.*, 2007) show evidence that respondents' choice of attributes is influenced by different factors, for instance, choosing a product under time pressure, lack of information provided, choice task complexity (e.g. (DeShazo and Fermo, 2002; Puckett and Hensher, 2008) or lack of familiarity with the available goods (Campbell *et al.,* 2008). Hole (2011) suggests that the reason for respondents not weighing up some attributes may reflect lack of credibility for some attributes. Campbell *et al.,* (2012) referred to a crucial distinction between AN-A based on lexicographic preferences and AN-A based on the rationally adaptive behaviour. The former concept based on lexicographic preferences is seen as a result of a simplifying strategy, and consumers may

still be maximising their utility. However, the latter concept based on rationally adaptive behaviour, this concept is linked with using the heuristic concept which may not reflect utility maximizing behaviour. Regardless of what is behind AN-A, ignoring AN-A in CEs may lead to biased estimates of attribute valuation.

Research has examined how respondents deal with information related to food product attributes in making their purchase decisions. It has been seen that simple and frugal heuristic methods may be used by respondents to make their food choices. The question that arises is why heuristic methods prevails in the food choice domain? There are several reasons why most people may make their food choices based on heuristic methods. With a large number of food choices that have to be made under time pressure constraints, or in order to simplify the decision of choice, people may prefer to make their decisions depend on simple strategies (Dhami and Ayton, 2001; Gigerenzer and Gaissmaier, 2011). In everyday life people need to make a lot of choices in the food domain. People may, therefore, rapidly gather their experience and knowledge of which information is useful for them and what kind of attributes they value most, this in its turn, give them the possibility to ignore information which they consider to be less important (Neuhouser *et al.,* 1999).

In the context of DCE, the reason for using heuristics to make decisions might be to reduce the cognitive burden of considering attributes (or their levels) that are not relevant to the respondent. In some stated choice experiments, the hypothetical scenarios presented to respondents may not be sufficient to influence their choices. Generally, the heuristic concept simply involves the use of "rules of thumb" for problem solving, simplifying the decision making process (Feigenbaum and Feldman, 1963) (p. 6). It is an approximate strategy to make a decision based on experience and find a solution, which although not certain to be optimal, is a satisfactory solution.

The decision-making process is not only important to consumers but also to policymakers and marketers. Consumers daily face many choices when making decisions during the purchasing process. Usually, consumers search for available information on the product from different sources. However, product evaluation is still a challenge faced by the consumer when making the trade-off between different options. In fact, available and complete information of a product will enable a consumer to make rational and realistic evaluations during decision-making and will make it easier to make trade-offs between a number of alternatives. This, in turn, will enable the consumer to estimate the utility for each choice and maximize utility in the purchasing decision. Recently, several studies have been focused on how individuals processes attribute information in CE, and how AN-A affects CE and WTP results. Campbell *et al.,* (2009)

found in a survey involving rural landscape attributes in the Republic of Ireland that 36% of the respondents ignored at least one attribute. Their results showed that the better model fits were obtained when the attributes non-attendance parameters were restricted to zero. Moreover, the WTP estimate of each attribute was lower while disregarding attribute non-attendance resulted in inflated WTP estimates. However, Carlsson *et al.,* (2010) found that while at least one attribute was ignored by the respondents, there was no change in WTP estimates due to attribute non-attendance.

Campbell and Lorimer (2009) found in their choice experiment that respondents who take all attributes into consideration were around 25%. There was also an improvement in the performance of the model and the WTP value was lower in magnitude when attribute non-attendance was incorporated. Hensher *et al.,* (2007) found that around half of the sample respondents attended to all attributes in the choice experiment sets. The origin of this research work has been discussed by (Hensher *et al.,* 2005b), where they pointed out the implications of attribute non-attendance for WTP estimation. They found that the model fit improves and WTP estimates are lower when the non-attended are restricted to zero.

One of the central aims of discrete choice experiments is to investigate preference heterogeneity of consumer behaviour. Preference heterogeneity (or preference source of variance) has become an important issue in discrete choice modelling. Generally, the meaning of heterogeneity is conceptualized as taste variation and it is treated in the model as interactions of individual characteristics with attributes of choice alternatives or recoded as unexplained variation across individuals in the parameters employed in the functions of utility. DeSarbo *et al.,* (1997) has defined sources of heterogeneity in consumer utility with respect to the variety of individual preferences. They explored heterogeneity as a result of differences in consumers' decision making processes. (Greene, 2003; Kline and Wichelns, 1998) note the significance of accounting for preference heterogeneity. Ignoring preference heterogeneity in the model can lead to biased estimation of utility parameters (e.g. biased estimates will lead in their turn to strange and misleading predictions of attribute evaluations and welfare measures).

Two categories of heterogeneity can arise in discrete choice models, observed and unobserved (Greene and Hensher, 2010). Observable heterogeneity can be captured by including socio-economic and demographic variables of the individual decision maker into the deterministic component of the utility function. Unobserved heterogeneity, by its nature cannot be observed by researchers and many techniques have been developed to incorporate unobserved heterogeneity in discrete choice models. The two most prominent techniques used to capture unobserved heterogeneity involve the use of mixed logit models and latent class models. (Train,

2003; Hensher *et al.*, 2005b) allow the taste parameters to vary in a random way over individual decision makers, in this respect, they capture unobserved heterogeneity through a mixed logit model. For latent class models, Kamakura and Russell (1989) capture unobserved segmentation heterogeneity according to taste, choice sets and the choice decisions. Unobserved heterogeneity technique can also be captured in psychology context (Tversky and Kahneman, 1974; Kahneman and Tversky, 1977). Greene *et al.*, (2006) explained the possibility of including the heterogeneity in unobserved effects variance using discrete mixed logit model. The diversity of consumer choice behaviour allows the scale of heterogeneity to be included in each specification (Fiebig *et al.*, 2010)[9]. Our implicit assumption is that the distribution of random parameters of product attributes normally distributed while the distribution of price (cost) parameter is assumed to be log normal[10].

DCE models are used for estimating willingness to pay. WTP presents the maximum amount a consumer is willing to pay for having a change in an attribute of goods or services. This approach has been applied in many disciplines such as marketing (Sonnier *et al.*, 2007; Balcombe *et al.*, 2015); environmental economics (Balcombe *et al.*, 2009; Scarpa *et al.*, 2008); transportation area (Hensher and Sullivan, 2003).

Information and knowledge about a product's WTP plays an important role in many areas in marketing management such as developing a new product or service which has not been previously available in the market or in applying a pricing strategy. Two prominent approaches have been used to estimate the distribution of WTP based on the application of DCEs. The first approach is estimating WTP in the "preference space" in which the random utility model is presented in terms of "partworths" or utility coefficients. In the preference space, the model is used to estimate utility coefficients and calculate WTP as a negative ratio of the attribute coefficients to the price coefficient. If the price coefficient, which is placed in the denominator of the WTP ratio, is arbitrarily close to zero then it will lead to heterogeneity distribution of WTP with long flat tails. Daly *et al.*, (2012) presented a study of WTP with different distributions used for the cost coefficient (since the cost coefficient represents the denominator of WTP ratio, then its distribution is mainly important in the distribution of WTP). The distributions used for the cost coefficient include normal, truncated normal, uniform and

[9] In marketing context, the consumer heterogeneity was exhibited in different ways for different models (e.g., the traditional multinomial logit (McFadden,1974) and multinomial Probit (Thurstone, 1927)), they assumed that the heterogeneity taste is confined on unobserved attributes of products while a common taste for observed attributes. To date, much recent work has been developed to allow the researchers to incorporate both observed and unobserved heterogeneity in the model (e.g. Train, 2003; Hensher& Greene, 2003).

[10] The Log-normal distribution has a positive probability domain only for values greater than zero and we specified the cost attribute (price) to have a log normal distribution to assure that it has a positive sign for all respondents and to avoid some issues regarding to a normal distributed price coefficient.

triangular. These distribution leads to imply infinite moments (undefined moments) for the distribution of WTP. However, to solve this problem, they used a simulation approach to obtain finite moments of WTP (moments are such as mean, median, St Dev).

The second approach is in WTP space; the utility model here is re-formulated to allow direct calculation of WTP estimations. Moving to WTP space gives a chance to improve the estimation of WTP and its distribution. (Train and Weeks, 2005; Sonnier *et al.,* 2007) show results from using two spaces; preference space and WTP space. They employed hierarchical Bayes for the estimation of mixed logit model with stated preference data on the choice of cars related to different fuel systems and cameras to make a comparison of the performance of models in the preference space and the WTP space. Their results confirmed that the models in preference space fit the data better than the models derived in the WTP space. However, Scarpa *et al.,* (2008) used revealed preferences data on site choice in the Alps to compare models in both the preference space and the WTP space. They estimate models using maximum simulated likelihood and hierarchical Bayes and derived consumers' WTP; their results conclude that the WTP space provides more realistic results and there is no trade- off between WTP estimation and model fit to data. The specification of WTP space can also provide a natural choice when the analyst can control the distribution of marginal WTP. Balcombe *et al.,* (2009) used mixed logit model in Bayesian approach to derive consumers' WTP on bread produced with a reduced level of pesticides to improve the environmental quality. They employed data generated from choice experiment. Their results provide strong evidence that the WTP space estimation is stable in their study unlike other previous studies which found that the WTP space is not stable. Hess *et al.,* (2006) gives a solution to WTP by using a finite mixture models including latent class models. In his specification, the continuous distribution has mass at a finite number of coefficient values. If all the points of the price coefficient estimated to be not equal zero, then WTP distribution will be finite and has defined values.

Chapter Four: Research Methodology

4.1 Introduction

This chapter is concerned with the enhancement of discrete choice models based on the theoretical framework of Consumer Behaviour Theory (CBT), Random Utility Theory (RUT) which mentioned in chapter three. Research methodology have been explained in detail in this chapter which include qualitative research methods: Focus Group (FG) and Verbal Protocol Analysis (VPA). Quantitative research methods include: first, Logit Model (LM), second, Probit Model (PM) and third Mixed Logit Model (ML) with three different specifications. Also, the design of discrete choice experiment is included in this chapter. The last section of this chapter includes an Econometrics Bayesian approach to statistical inference.

4.2 Qualitative Research Methods

Ritchie *et al.,* (2013) pointed out that qualitative market research methods in general seek to investigate and realize the most important attitudes, thoughts, preferences, motivations and behaviour of the consumer during the buying process. Ritchie also mentioned that qualitative research methods are useful for the interpretation of different phenomena and the investigation of various questions such as 'why' and 'how' of certain behaviours or phenomena. Qualitative research methods allow us to examine beyond the 'what' and investigate further the feelings and the taken-for-granted habitual and culturally derived attitudes and behaviours. This study utilizes the following qualitative research methods: focus group discussion and verbal protocol analysis.

4.2.1 Focus Group Discussion

Focus Group (henceforth FG- also called "focused groups" or "discussion groups") is a method of data collection often used in the context of application of stated preferences techniques for identification of attributes and levels and widely used in marketing research field. Höijer (2008) states that the purpose of FGs is to stimulate new ideas for both the decision maker and consumer. It can help in providing general background information on a specific topic, and the insights derived from it can inform the design of quantitative methods.

FG is a commonly used method within the qualitative research tradition. It usually involves a small group of people, usually between 8-10 participants, that are engaged in an open discussion, guided by a skilled moderator (Krueger and Casey, 2014). Estimates of the ideal number of the participants in an FG have ranged between 6-12 participants. A very small number of participants may not stimulate a good conversation and elicit useful information. An

experiment done by (Fern, 1982) (p.12) showed that conducting focus group discussion with a group consisting of eight participants was more efficient than a discussion between four participants. On the other hand, conducting focus group discussion with a large number of participants might be lead to ideas and inputs from some participants being missed. It is generally considered to be appropriate to select participants unknown to one another to facilitate a conducive discussion environment where participants feel free to talk and discuss without any censoring. Sim (1998) considers that homogeneity among participants can play a crucial role to ensure expression of different points of view and to create a relaxed, comfortable and natural environment for all participants.

The approach to recruitment of focus group respondents is still difficult and expensive and in a debate between practitioners of qualitative research study groups. It has been suggested that in order to ensure that participants meet selection criteria, recruitment should be done using a quick questionnaire (Market Research Society, 1979; Welch, 1985). Wells (1974) suggest some methods to recruit focus group participants for instance by telephone or door to door canvassing. In this research, the recruitment of participants has been done by Sensory Dimension Ltd Company; eight participants were recruited to attend FGD, three of the participants were organic olive oil consumers and the five of them were non- organic olive oil consumers.

While the duration of FG discussions varies, they generally take an hour and a half to two hours to run. The atmosphere of the discussion is expected to be neutral, non-judgmental and non-threatening, which will allow the participants to express their opinions and ideas freely (Suh, 2002). FG discussions are generally audio/video- recorded with the permission of all the participants. The location for the FG discussion must have adequate space to accommodate all participants, have convenient facilities, be familiar to participants and ensure privacy for participants.

The person who leads FG discussion is called "moderator" and s/he plays a key role in conducting a focus group discussion. The moderator should have a good knowledge about FG topic and needs to have some important skills such as: time management, ability to manage the discussion flexibly, the ability to probe deeply and steer the discussion from simpler to more complex issues, the ability to engage all participants in the discussion especially those who are uncomfortable with speaking in a group. A protocol for the discussion is generally prepared in advance to let the conversation stay smoothly on track and to ensure that participants do not lose interest.

FG discussions are generally supported by a facilitator and a note-taker. The facilitator assists the moderator with the video-recording and logistics of the discussion, while the note-taker takes notes on the responses of participants (e.g., emotional cues) which may help in the analysis of the data later. Ethical clearance for the study was taken following the ethical clearance procedure on the University of Reading. Participants were provided with an information sheet explaining the purpose of the study. They were also given a consent form and were informed about their right to withdraw from the discussion at any stage along with the usual assurance of confidentiality and anonymity. (For more details; see Appendix 2).

The purpose of the FG discussion was to elicit viewpoints, attitudes and opinions of participants about organic olive oil and organic olive oil sourced from Syria. This in turns was expected to inform the further design of the DCE by understanding how consumers respond to, and feel about, different attributes (and their levels) of organic olive oil in general and Syrian organic olive in particular. The FG was intended to identify the most relevant attributes of organic olive oil to be included in the DCE.

Focus group research is an economical, fast and efficient method to get the data quickly from different perspectives (Krueger and Casey, 2014). In addition, the interaction between different participants can yield good insights for understanding consumer behaviour (Morgan, 1997).

A structured protocol of focus group discussion was prepared as a fixed design which means having a set of questions and procedures planned in advance (See Appendix 2) A weakness of focus group discussion is that one or two participants may take a dominant position in the discussion introducing bias such situations have to be managed by the moderator by facilitating opportunities for all participants to take part in the discussion.

After the FG discussion was completed, the data was transcribed after listening to the audio recording a number of times. Next coding was undertaken to support the thematic analysis of the data by putting the text into categories to get patterns observations by the participants regarding the product under discussion.

4.2.2 Verbal Protocol Analysis

Verbal Protocol Analysis (henceforth VPA) is a qualitative evaluation technique which attempts to capture cognitive processes associated with consumer behaviour and is often undertaken in conjunction with other methods such as focus groups discussion and discourse analysis (Bracewell, 1994; Greene and Higgins, 1994). VPA method involves making a detailed record of a participant's speech during (concurrent) or immediately after (retrospective) completing a task (e.g. while purchasing a product). VPA can be based on the participant

"thinking out aloud" while completing a task or by "verbalising" the thought process after completing the task with some prompting from the interviewer.

The key features of VPA are noted below: first, VPA has two variants and it is important to differentiate between the two. If a participant thinks out aloud while performing the task; then it is referred to as the "concurrent protocol"; in other words, the participant speaks while performing the task and there is no prompting questions by the [11]experimenter or interviewer (e.g. (Cumming, 1990)). If the participants report after completing the task, it is referred to as the "retrospective protocol", where the experimenter may prompt and encourage the participant to continue talking (e.g. [12] (Austin and Delaney, 1998; Mackey, 2002; Swain and Lapkin, 2002). The participants' speech is transcribed, segmented into blocks and coded to get inferences about the cognitive processes during the performance of the task. VPA is used in widely of cognitive psychology applications. However, there are a clear distinction between VPA and other methods used in the same area such as conversation analysis and discourse analysis which depend on linguistic analysis. Second, it is a crucial to distinguish between having a participant who thinks aloud while completing the task and the participant who only describes and explains the thought process while performing the task. In the latter, the participant concentrates on giving an explanation of what he/she is doing rather than simply doing it. A very good example has been explained by Ericsson and Simon (1993). Third, Trickett and Trafton (2009) pointed out that the researcher should be aware in interpretation VPA data especially if there is some incomplete information within the data, the risk is where the researcher may think that s/he knows what the participant intended to say or the meaning of some utterance words and thus the interpretation will be wrong. Despite these limitations, VPA is considered one of the best methods to understand the cognitive processes associated with consumer behaviour which can be employed and completed rapidly.

Before conducting the verbal protocol process, there are certain steps to be followed. Consent of the participants needs to be obtained for recording the process and for use of the participant's speech for analysis. The participants should have full understanding of what the process involves[13]. Participants need to be given assurances of data confidentiality and information related to how the data will be stored and used.

The researcher should be clear about the purpose of the VPA. Irrespective of the nature of the task, VPA involves several steps. As a first step, it is important to specify the task to be

[11] Researcher

[12] For more details about two forms see: Austin & Delaney (1998) Protocol analysis as a tool for behaviour analysis. The Analysis of verbal behaviour.

[13] For more details; see Appendix 3

undertaken by the participants and the researcher needs to decide whether to use the concurrent or the retrospective protocol. The researcher should be neutral, unbiased, non-directive and supportive to help in completing the procedure. The second step involves instructing and prompting the participants. Participants can be invited to think loudly while doing the task. However, while participants are performing the task and thinking out aloud, they should not be asked to explain their thinking or given any prompts in order to avoid bias. Only after the participant stops talking and falls silent should prompts be given to push the procedure forward (e.g. is there anything else you would like to add…?)[14]. The third step involves video or audio taping the entire process. The final steps of VPA involves full transcription and analysis of the data by segmenting the data into blocks and creating a coding framework.

The number of participants required for VPA depends on the experience and skill of the participants in the relevant task. Fewer participants are required if participants have expertise in the task involved.

The VPA for this study sought to motivate the participants to verbalize thoughts and ideas and experiences about olive oil products to understand how consumers perceive different characteristics of olive oil products and make their choices. VPA provides information about how consumers respond to product cues and product alternatives. Analysis of the expressions that they use can be helpful in understanding the criteria that consumers use evaluating different olive oil products and making their choices.

The objective of VPA in our study was to make consumers go through the task of purchasing olive oil products and capturing the verbalisation of their thoughts to draw inferences about the perceptions, preferences, opinions, ideas and purchase decision making. In addition, verbal protocol analysis report is an appropriate tool to investigate how consumers evaluate new product features in the light of different product alternatives, attributes and levels in the overall product category. In this study, VPA data was collected from a small sample of participants (9 recorded observations) who were consumers of organic and non-organic olive oil. The protocol includes recorded observations (written, audio, or video recordings). The recorded data provides information in regard to the ways consumers verbalize their thoughts when talking loudly during the task of purchasing organic olive oil. The transcriptions of each 'think-aloud' session is analysed immediately after finishing the task using qualitative data analysis package (excel spreadsheet).

[14] For more details; see Appendix 3, there are some prompt questions included in that appendix.

4.3 Design of Discrete Choice Experiment

Discrete Choice Experiment (henceforth DCE) is a quantitative research technique used in a variety of situations in market research, health economics and consumer food research. The conceptual framework of choice modelling is grounded in (Lancaster, 1966) theory of value, and random utility theory (Thurstone, 1927; Manski, 1977). Lancaster's theory of value assumes that the utility derived by consumer from a good can be decomposed into the utility derived from different characteristics or attributes of that good.

Choice modelling is mainly used to study consumers' preferences for certain product attributes or services in different areas; sometimes it is called conjoint analysis experiment and sometimes it is called stated choice experiment. One of the key features of DCE is that it allows respondents to choose between different options for a product or a service comprised of a number of attributes of varying levels (Balcombe *et al.,* 2008). DCE involves the design of choice sets with a varying combination of attributes and their levels. A series of choice cards are presented to respondents to elicit their preferences and their ranking of the relative importance of product attributes. The design of a choice experiment involves several stages. The initial stage of identifying product attributes and their relevant levels is often informed by qualitative methods (Hensher *et al.,* 2005; Coast *et al.,* 2012). Ferrini and Scarpa (2007) explain the design of choice experiments in environmental economics in different steps to identify attributes and their levels by conducting focus group discussion and using a D-optimal design.

Designing a DCE, involves several different stages and depends on the issue that is under consideration and the research objectives of the study. Many researchers have contributed towards the improvement of DCE design, among them Green and Srinivasan, (1978) & Ryan, (1999). Figure 4.1 illustrates the design divided into five stages:

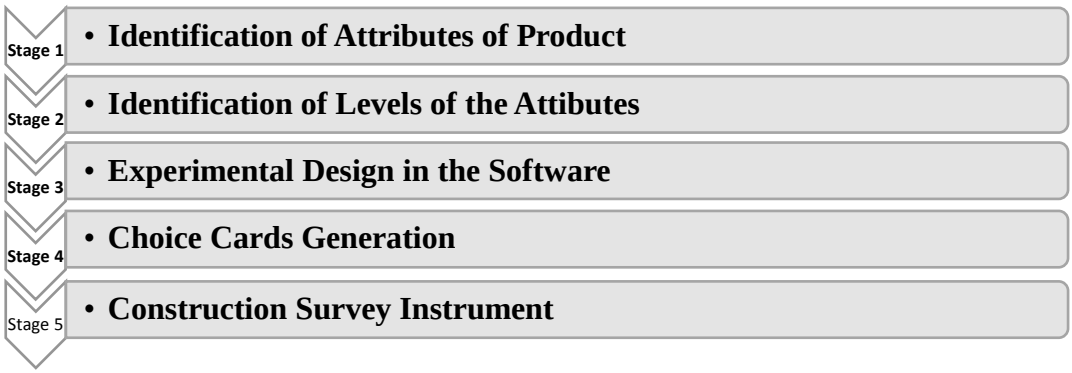


Figure 4.1: The Design of Discrete Choice Experiment.

4.3.1 Stated Preferences Choice Technique

Over the last few decades, stated preferences techniques have been widely developed for eliciting consumer preferences and estimating willingness to pay for a new product or an existing product with new attributes. The techniques can also be used to elicit consumer valuation of different attributes of a product. All these techniques involve asking respondents to choose between competing options. Merino-Castello (2003) classified stated preference methods into two main methods; first, Contingent Valuation (CV) which includes Open-Ended CV and Referendum CV. Second, Multi-Attribute Valuation (MAV) includes preference-based conjoint analysis (Contingent Rating and Paired Comparison) and Choice -Based Choice Modelling (Contingent Ranking and Choice experiment).

In this research, it is used a stated preference discrete choice experiment where respondents are presented with a set of hypothetical choice cards and asked to choose their most preferred option. A status quo option is often included in a choice card set as a baseline in each choice card; this is in its turn helpful to interpret the results in standard welfare economic terms.

It has been shown that choice experiments can produce estimates of WTP consistent with changes in welfare (Bateman *et al.,* 2002b). Choice experiments have also been shown to be consistent with the utility maximisation demand theory when a status-quo option is included in the choice set (Hanley *et al.,* 2001). DCE techniques offer a number of advantages in relation to revealed preference approaches. Unlike, revealed preference approaches, DCE techniques are not restricted in their application to products actually present in the market place. DCE techniques also provide a lot of information on the consumer valuation of individual attributes of a product and on the interaction between these different attributes which are not available from the application of revealed preference techniques.

4.3.2 Stages1&2: Identification of Attributes and Attribute Levels

The first stage of the design of a DCE involves the identification of the attributes (also called factors) and attribute levels for the product or service being investigated. Qualitative methods such as interviews and focus group discussions are often used to identify the most important attributes of the product and their relevant levels. Qualitative methods are useful for clear identification of attributes that will be well understood by respondents in the context of choice experiments (Abboud and Said, 2010; Kuper *et al.,* 2008). Attributes identified in previous empirical studies about the product in question can also be a useful starting point for identification of product attributes for a DCE. In general product attributes that are relevant to consumer decision making should be chosen. The choice of product attributes to be included in

the DCE also depends on the specific attributes of interest to the marketer or policy maker (e.g., the organic or non-organic characteristic of a product would be a relevant product attribute if the marketer or policy maker is interested in promoting the organic version of the product).

Although there is no standardised procedure for selection of attributes to be included in a DCE, Bennett and Blamey (2001) provide two guidelines for identification and selection of attributes in CE. The first guideline of selection attributes should be meaningful and determinant for respondents, for example, determinant attributes are consumer's orientations toward products or goods which are related to preferences or to actual purchase decisions. The second guideline of selection attributes in CE is related to be relevant and actionable for policy decision, Lancaster (1991) distinguished between relevant and irrelevant attributes; Lancaster considered that the attribute is relevant to include in CE if ignoring its existence in the experiment would make a change in the conclusion about consumer's choice and vice versa for irrelevant attribute.

While there are no general rules for the determination of the number of attributes to be included in a DCE, some researchers have suggested that the number of attributes used should be around eight (Ortuzar and Willumsen, 2001). Focus group discussions are an effective method to determine the most important attributes to be used in a choice experiment while keeping the number of attributes at a manageable level. It is important to distinguish between relevant and irrelevant attributes. Ignoring important attributes can result in biased and inaccurate estimations of attribute valuations or willingness to pay for the product (Kjaer, 2005). Selection of relevant attributes in a DCE is important for obtaining robust estimates of willingness to pay. Monetary attributes (such as price, cost) have to be included as one of the attributes in a DCE to estimate WTP measures.

A number of empirical studies have examined the effects of including a large number of attributes in a choice experiment on the respondents' ability to process the information and the reliability of the WTP estimates obtained. Witt *et al.,* (2009) investigate the relative importance of using a large number of attributes in a choice experiment. Mazzotta and Opaluch, (1995) found that including too many attributes in a choice experiment can limit the respondents' ability to process attribute information due to the cognitive burden involved.

However, Arentze *et al.,* (2003) applied stated choice experiment to evaluate the effects of choice task complexity in transportation research for a work trip in the South-African context, they found that increasing the number of attributes (three to five) has an influence on respondents choice which clearly increase the error variance of attributes. Caussade *et al.*, (2005) examined stated choice experiment in terms of complexity and cognitive burden, the

complexity of the experiment has analysed in different design dimensions such as different numbers of alternatives, different numbers of attributes in the choice cards and different attributes levels. They found that the number of attributes had an influence on the error variance of variables out of other design dimensions.

The second stage of DCE is determining the appropriate levels for each attribute (Ryan, 1999; Lancsar and Louviere, 2008). Attribute levels may be specified quantitative or qualitative. For example, price levels are chosen in the experiment as £2, £3.16, £4.99, £ 5.30, £6 which represent quantitative values, while the levels of the colour attribute are specified as "yellow", "green" or "dark green". Bennett and Blamey (2001) & (Ryan, 1999) suggest the use of three criteria when considering the selection of attribute-level labels. First, attribute-level labels should be acceptable to the consumer. Second, they should provide useful information to respondents. Third, labels must be made in such a way that respondents are willing to trade-off between combinations of the various attributes. Once again, attribute levels should be clear, relevant and easy to understand by the respondents.

Hanley *et al.,* (2001) state that the choice of levels for each attribute should be feasible and realistic. Focus group discussion and literature reviews and pilot surveys are focal sources in selecting appropriate attribute levels. A status quo level is generally included as a baseline in choice experiments (see section 4.3.3.1 for more explanation of SQ).

The levels of attributes should be in an acceptable range for the respondents to enable them to make trade-offs successfully (Green and Srinivasan, 1978). This is important for the design of the DCE because the levels of attributes influence the willingness of respondents to make trade-offs. Determining the attribute levels is also crucial because it will determine the type of effect in the choice experiment (e.g. a two level attribute allows the estimation of linear effects, while more than two levels will allow the estimation of non-linear effects). Ratcliffe and Longworth (2002) pointed out that the number of levels chosen for each attribute is important in choice experiment application because respondents are more likely to give more value to attributes with more levels. The attributes and their levels were identified for this study for olive oil products based on focus group discussion and verbal protocol analysis (see Section 4.2.1 and 4.2.2). Table 4.1 describes the nine attributes of olive oil products and their levels used in the DCE.

Table 4.1: Explanation of Olive Oil Attributes and their Levels.

Attributes	Levels	Explanations
1. Organic	Yes No	Certified Organic for olive oil is made from 100% organically and naturally grown olives, without any pesticides or chemical fertilizers.
2. Country of Origin	Syria Italy Greece Spain	- Mediterranean countries. - High level of olive oil production.
3. Colour 	Yellow Green Dark Green	The appearance of the olive oil, related to the amount of chlorophyll. Olive's fruits that are picked early in the season tend to produce green coloured oil.
4. Packaging	Glass bottle Plastic bottle	Packaging refers to the way the olive oil is packaged in the bottle.
5. Flavour	Fruity Nutty Bitter	Flavour refers to the aroma of olive oil. -**Fruity**: refers to aroma of fresh olive fruits, which is perceived through nose. It called "fruitiness, robust, freshness" -**Nutty**: refers to aroma of almond and its fresh and not oxidized. -**Bitter**: considered a positive attribute because it is indicative of fresh olive fruits. Comes from a mistake in the process of extracting the oil. The amounts of Polyphenols determine the bitterness.
6. Type of Olive Oil (Grade).	Extra-Virgin Olive Oil. Standard Olive Oil. Light Olive Oil.	-The degree of acidity of olive oil **Extra-Virgin Olive Oil** has the best olive oil quality. **Standard Olive Oil** is a blend of refined and unrefined olive oil, and is of lower quality compared to extra-virgin. **Light Olive Oil** is a refined olive oil and it is of lower quality compared to extra virgin.
7. Taste	Strong Smooth	The taste of olive oil is as an intrinsic cue of the product characteristic. We have two types of taste: **Strong, Smooth**
8. Fairtrade	Yes No	Fair trade product is where the farmers will receive a fair price for their products and engage in environmentally - friendly practices to produce the olive fruits.
9. Price	£2 £3.16 £4.99 £5.30 £6	The amount of money you pay to buy the product.

Source: Focus Group Discussion & Verbal Protocol Analysis, 2013.

4.3.3 Stage 3&4: Experimental Design and Choice Set Generation

The design of choice experiment required to generate combinations of attributes at different levels to present them in choice sets of alternatives (also called choice cards). The construction of each alternative and the combinations of alternatives in each choice set forms the experiment design. Using the stated preference method to CE design creates a number of hypothetical scenarios to be presented to respondents in the survey instrument.

CE approach in different disciplines like in marketing and transport and health economics has often used orthogonal designs where the attributes of the product have zero correlation to be orthogonal, while the optimality criteria is recently used to design CE, where the optimality is obtained by minimizing or maximizing the determinant of the Fisher information matrix based on the objective of CE. However, there is no general agreement to confirm what is the best design of CE (Gao *et al.,* 2010).

The most common approach used in CE is D-efficiency design. The goodness or efficiency of a CE design can be measured. The measurement of efficiency of the design matrix **X** is based on information matrix X'X (also called Ω matrix or Fisher matrix). The variance of the vector of parameter estimates $\hat{\beta}$ is Var (β) = σ^2 $(X'X)^{-1}$. Since σ^2 is constant and assumed equal to one. Then the diagonal elements of $(X'X)^{-1}$ are variances estimates. The efficient design has a small variance design and the process to minimizing the variance in the matrix depends on the selection of the entries in X and not on σ^2. Therefore, D- efficiency can formulate for K parameters as: D- Efficiency = $[|\Omega|^{1/k}]^{-1}$. To minimizing error around the estimated parameters, inversely related to D-efficiency: D- error = $(\det \Omega^{-1})^{1/k}$

CE design for this research based on D-efficiency design because D-efficiency is easy and fast to obtain through running GAUSS software. Also, compared with other designs such as A-efficiency or G-efficiency, D-efficiency design gives invariant with regards to coding schemes. In Bayesian econometric approach, efficient design depends on the prior knowledge of the coefficient vector, this knowledge comes from different resources such as analyst's experience, similar studies in literature, or from pre-testing the design. To explain how D-efficiency works in this research, the set of attributes and levels constitutes a full fractional factorial design with $(2^4 * 4^1 * 3^3 * 5^{1)} = 8640$ combinations. By means of Bayesian efficient design, based on the minimization of the D-error criterion, it reduced this number to 48 choice sets, which in turn have been blocked into four blocks of twelve cards. It was also added to those combinations four choice sets related to price indicator to test if the consumer still considers the price as a signal of high quality.

Every design has its specifications and its advantages to figure some effects and also there is no superior design suitable for all purposes (Chrzan and Orme, 2000). Other studies take the design dimensionality into consideration; such as the number of product attributes used in choice experiment, how the design affect the consumers' preferences and evaluations (Islam *et al.*, 2007; Hensher, 2006; Gao and Schroeder, 2009). The aim of using D-efficient design is to get an accurate response predictions, as well as exactly the same aim of discrete choice experiment does. The impact of an appropriate experiment design will reflect by obtaining an accurate estimate for the model parameters[15] and derived measures such as willingness to pay and welfare measurement (Hess *et al.*, 2008). (Louviere *et al.*, 2009, Louviere *et al.*, 2011) identify the importance of choosing an accurate design, however, accepting the limited resource of empirical work which is necessary to conclude the outputs of experiment.

Three approaches to design the stated choice experiment have been discussed by (Bliemer and Rose, 2010), orthogonal design methods and D-optimal design methods under the null hypothesis and D-efficient design methods under the non-null hypothesis: first, The orthogonal design in definition is the choice design where the attributes have zero correlation to be orthogonal, it means each attribute is an independent variable of all other attributes, the assumption of orthogonal design is that the orthogonality happens only for attributes within alternatives, not between alternative. Briefly, the most common orthogonal design for labelled experiment is known as: $\mathbf{L}^{\boldsymbol{MA}}$ (Where: $\boldsymbol{L}$ is the number of levels, $\boldsymbol{M}$ is the number of alternatives. and $\boldsymbol{A}$ is the numbers of attributes.) If there is no alternative the choice card will be $\mathbf{L}^{\mathbf{A}}$. Second, the D-optimal design methods under the null hypothesis are tested to construct "optimal sequential orthogonal design" under the assumption that all the coefficients are zero, the design is minimizing all the components of AVC matrix by assuming all parameters will be zero and the attributes is orthonormally coded (Bliemer and Rose, 2010), practically, such a design can help in increasing the "trade-offs" process to let the respondents make their choice across all attributes maximizing the information gained with regards to the significance of each attribute in the experiment (Burgess and Street, 2005; Street and Burgess, 2004; Street and Burgess, 2007; Street *et al.*, 2005; Rose and Bliemer, 2009). Third, D-efficiency design methods under the non- null hypothesis, in this design, AVC matrix provides values as small as possible under the assumption of non-zero parameters, since the asymptotic standard errors of the parameters gained from discrete choice models equals the square roots of the leading diagonal of AVC

[15] Bliemer *et al.*, (2011) provides the effects of potential designs which can affect the parameters estimates; first, the efficient designs might probably give higher T-values (Toner *et al.*, 1999). Second, the statistical efficiency level of the design is positively correlated to greater error variance (Louviere *et al.*, 2008)

matrix, the smaller elements of the AVC matrix will lead to smaller asymptotic standard errors for every parameter. Dividing the parameters estimates by asymptotic standard errors will give asymptotic *t*-ratios, therefore, the smaller asymptotic standard errors will give larger asymptotic *t*- ratios. Overall, the efficiency design is obtained when minimize the elements of the AVC matrix. The efficiency design has different assumptions based on different models used in research, for instance in logit model, the AVC matrix is equal to the negative inverse of the model's Hessian of the log-likelihood function (Bliemer and Rose, 2010). Scarpa and Rose, (2008) reviewed the difference between the orthogonal and efficient designs with focusing on the efficiency of WTP estimation from multinomial logit model, they state also applied studies to make a comparison between D-, A-, B-, S- and C- errors. As a result, Scarpa and Rose (2008) considered that if the analyst would like to yield model results which minimize the standard errors and the covariance of the parameters estimates then D-error criteria should be employed.

4.3.3.1 Status Quo Option Effect in Discrete Choice Modelling

Status Quo (henceforth SQ) refers to the current situation found in the market. The SQ option is generally included in choice cards as a baseline or default option in order to derive welfare consistent estimates of WTP. However, if SQ is not presented in the choice card and respondents are forced to make their choice from among other alternatives, then the estimates of WTP obtained may not be welfare consistent.

Boxall *et al.,* (2009) examined the tendency of respondents to select the SQ option as a function of complexity in two CEs and to what extent complexity in the choice set can encourage the respondent to choose SQ as a heuristic strategy. They found two possible reasons for SQ choices. The first one is the omission SQ bias and avoiding choice where respondents may choose the SQ option because they want to avoid the complexity of choice and simplify decision making (Ritov and Baron, 1992; Baron and Ritov, 1994; Schweitzer, 1994; Tversky and Shafir, 1992). The second reason is the endowment effect which with indifference curves being kinked at the endowment point (this is considered an "irregularity in the economics literature). While most studies ignore SQ effects, if SQ effects represent actual behavioural phenomena then they need to be taken into consideration in welfare measurement. For this research, it has considered different scenarios for SQ option. To deal with SQ option, an econometrics models (i.e. Mixed logit and Probit model) applied for different scenarios such as including SQ option, excluding SQ option, and including SQ option with socio demographic characteristics. It was explained in detail in chapter seven that the results presented showed that the inclusion SQ option gave more robust and strong findings rather than excluding SQ.

A number of explanation from economics, psychology and decision making theory have been offered to take into consideration the effect of the SQ option in the DCE; Bonnieus *et al.,* (2006) argue that the SQ option may be chosen because it is known with certainty while the realisation of the alternative options (alternative product offerings or environmental services) may be uncertain. Risk averse, individuals may systematically opt to have SQ as their favoured option (Samuelson and Zeckhauser, 1988). Kahneman *et al.,* (1982) take the view that "loss aversion" of people can make them prefer the SQ option to avoid comparing alternatives in risky situations. A behavioural characteristic of individuals can be rejected when there is any kind of change in making choices and they can simply focus on their current endowment (Kahneman *et al.,* 1990; Tversky and Kahneman, 1991). Adamowicz *et al.,* (1998) include the endowment effects and loss aversion, while Hanley *et al.,* (2005) discuss the strategic behaviour (i.e. protest bids) and the rejection of hypothetical market.

For the purpose of this research, SQ option was included in every choice card in the choice experiment and was presented as the first option in each choice card (See Second section of Survey online II in this chapter). The SQ option included the following attributes: non-organic, Italy as country of origin, green colour, in a glass bottle, fruity flavour, smooth taste, extra virgin type and non-Fairtrade for a price of £3. 16 (per 500ml).

Another consideration taken into account in the design of the CE is whether the experiment should be labelled or unlabelled (Rose and Bliemer, 2014). A labelled experiment is one that uses names for product alternatives which have substantive meaning to the respondent other than indicating their relative order of appearance, e.g., the alternatives might be labelled Advil, Tylenol, and Aspirin). In unlabelled experiments names of product alternative convey only their relative order of appearance like drug A, drug B and drug C. This is relevant for the type of product attributes that are included in the study. Usually, in unlabelled experiments only generic product attributes are included whereas in labelled experiments both generic and alternative-specific attributes may be included.

Two main considerations have been discussed by (Chung *et al.,* 2011) about the number of the alternatives in each choice card and the number of choice sets which included in the survey. They found that changing the number of alternatives and the number of choice card sets could affect the estimates of WTP. Other previous studies have examined the effects of choice cards complexity (Carlsson and Martinsson, 2008; DeShazo and Fermo, 2002; Jacoby *et al.,* 1974; Keller and Staelin, 1987).

4.3.4 Stage5: Constructing the Survey Instrument

The Discrete choice experiment exercise follows a typical design structure for the stated preference technique (Bateman *et al.,* 2002a). As highlighted earlier, focus group discussion and verbal protocol analysis were conducted to identify the attributes of olive oil product and their levels. A choice experiment online survey instrument was developed which was pre-tested/ the sections of the final survey questionnaire are briefly discussed and the details are in Appendix 4.

4.3.5 Pre-Testing the Survey

Before implementing the survey, it has to be ensured that the survey instrument has an acceptable level of reliability and validity. Theoretically, validity refers to the ability of the instrument to measure what it is supposed to measure (Kimberlin and Winterstein, 2008). Content validity refers to the extent by which questions in the survey can elicit the required information. This was sought to be done in this study by having the survey instrument appraised by supervisors and staff experienced in choice experiment techniques and consumer behaviour area. Reliability refers to the precision and accuracy of the survey responses. The survey questions should avoid any ambiguity which may bias the responses of the survey participants. The survey instrument is generally pre-tested to assess its validity and reliability and assess how respondents understand the survey questions. The results and feedback from the pre-test were used to fine tune the final version of the survey instrument. For the present study, a pilot test was administered to 30 respondents (British consumers of olive oil in the Reading area) in order to ensure that the survey is clear enough and the information was well understood by respondents. Redundant questions and questions not easily understood by the respondents were identified. Based on the pre-test outcomes, modifications were carried out to the final version of the survey instrument by removing some questions and modifying others. The final version of the survey is explained in appendix four.

The updating design of the survey was achieved from the pilot study with 30 respondents face to face filling the survey and the 50 respondents' online pre-test of the survey.

4.4 Research Methods for Discrete Choice Modelling

It was mentioned earlier in the theoretical framework that the random error term of the utility function can determine a variety of different models in terms of the distribution and the correlation structure of (ε_n). The assumptions underlying the distribution are not only cover the error term but also comprise the distribution of β' to define different types of models. The models within the Logit family are mostly based on the probability distribution function of the random variables such as Gumbel distribution for logit model, Normal distribution for probit

model and so on. Most of Logit family models and their extensions have been used discrete choice modelling for applying sated preference (SP) data in diversity of different disciplines.

4.4.1 Logit Model

The development of the choice modelling can be defined as a search of flexible models adapting to a practical situation. However, this search has been illustrated by a flexibility of the trade-off models. On one side, there are the Logit family models which offer closed choice probability forms, but with restrictive assumptions which do not always offer a proper justification for their restriction. Relatively, it seems that the logit model is easy computation and the interpretation is possible in terms of *iid* restrictions (Train, 2003). On the other side, the probit model has a flexibility to work with an error term structure with further efforts in estimation and identification of the restrictions. In fact, the logit form was introduced by Luce (2005) from IIA assumptions about the characteristics of choice probabilities. Marschak (1960) prove that the logit formula is consistent and reliable with the concept of maximum utility function, while Marley, as cited by (Luce and Suppes, 1965) mentioned that imply extreme value distribution to the unobserved component in utility function is quite suitable to logit model. (McFadden, 1973; McFadden and Train, 2000) tried to prove the opposite side of that, it means the logit model for choice probabilities necessarily implies the extreme value distribution to the utility function.

As highlighted earlier the utility function (3.1) is consist of systematic component $V(X_{nit}, \beta_n)$, the most common specification of this part of utility that is considered linear in parameter function form (Louviere, 2004; Louviere and Woodworth, 1983; Manski, 1977). And the error term ε_{nit}, the main assumption to the logit model is that the error term is *iid* (i.e. Independently and Identically Distributed) extreme value or also called Gumbel or extreme value type I. the density function for each unobserved error term of utility is:

$$f(\varepsilon_{nit}) = e^{-\varepsilon_{nit}} e^{-e^{-\varepsilon_{nit}}} \tag{4.1}$$

And the cumulative distribution function is:

$$F(\varepsilon_{nit}) = e^{-e^{-\varepsilon nit}} \tag{4.2}$$

Then the logit choice probability is:

$$P_{nit} = \frac{e^{Vnit}}{\sum e^{Vnjt}} = \frac{e^{\beta n' \chi_{nit}}}{\sum e^{\beta n' \chi_{njt}}} \qquad \text{Where } \beta_n = \beta' \tag{4.3}$$

According to Train, (2003) the logit model has three main limitations which should be taken into consideration, which include, first, the obstacle is the "taste variation" where logit formula can reflect systematic taste variation related to observed variables and does not reflect random taste variation for unobserved variables. (Example is available in Train, 2003 textbook, p: 51). The second limitation is about the "substitution patterns" across alternatives, the logit model implies a certain pattern across alternatives. If the substitution happened in a way that rises the probability of the individual choice then the logit model is appropriate, otherwise, more flexible models are needed. The third limitation is "repeated choices over time", the logit model cannot handle the issue when there is a correlation between unobserved factors over time.

4.4.1.1 Independence of Irrelevant Alternatives (IIA) Property

The Independence of Irrelevant Alternatives (henceforth IIA) assumption implies that the characteristics of one particular choice alternative do not impact the relative probabilities of selecting other alternatives. Put differently, IIA assumption states that the probability ratio[16] of persons selecting between two alternatives is independent of the availability of other alternatives (Louviere and Timmermans, 1990; Poirier, 1997, Poirier, 1998). A very simple example of the concept of IIA; if IIA property is validate, is how to choose between watching a movie or attending a tennis match. This is independent of the person who is giving a concert that day. Therefore, if a set of choice sets includes the alternatives A and B, the odds of choosing A over B must be the same for each choice set regardless of the other alternatives present (Louviere and Timmermans, 1990).

IIA assumption is realistic and accurate in some cases in choice models and if it is validated then much is gained from the model. However, violation of the IIA assumption makes the situation complex in some choice modelling. The IIA assumption is violated when changes to the attributes of a particular alternative influence the choices of other alternatives in the choice card (Louviere and Timmermans, 1990). Other researchers such as (Morrison *et al.*, 1998) pointed out that the IIA violation happened because of the existence of random taste variations (i.e. heterogeneous preferences) or the inclusion of close substitutes in choice sets. Moreover, the IIA is restricted especially in the case of having a large number of alternatives in the choice set. The issue of violating IIA sometime leads a model to incorrectly predict the probability of the alternative (Cushing and Cushing, 2007). In this respect, several attempts have been conducted to relax the IIA assumption which include mixed logit model, multinomial probit,

[16] For any two alternative (*i*) and (*k*), the ratio of the logit probabilities is $\frac{Pni}{Pnk} = \frac{e^{V_{ni}} / \sum e^{V_{nj}}}{e^{V_{nk}} / \sum e^{V_{nj}}}$ This ratio does not depend on any alternatives other than (*i*) and (*k*) (Train, 2003).

heteroscedastic extreme value models...etc. Swait and Louviere (1993) argue that from statistical viewpoint, more scale/variance terms could be included to handle the IIA violations. The solution will be sufficient when examining marginal trade-offs between attributes. And in terms of deriving willingness to pay, the correct scale factor is required (Carson *et al.*, 1994).

In IIA setting, Luce, (2005) derived the logit model directly from an assumption that the choice probabilities exhibit IIA. However, Train (2003) derives the logit model from the assumption related to the distribution of unobserved utility and then they observe the IIA as a resulting property. In fact, a test of IIA property has been developed by (McFadden *et al.*, 1977), for the first type of IIA test, the model is re-estimated on a subset of the alternatives, the results informed that the parameter estimates obtained on the subset of alternatives will not be significantly different from those obtained on the full set of alternatives, this type of testing IIA is supported as well by (Hausman and McFadden, 1984). For the second type of the test, the model is re-estimated with new, across-alternative variables. For example, if the ratio of probabilities for alternatives (*i*) and (*k*) depend on the existence of a third alternative *j* (violate IIA), then the attributes of alternative *j* will enter significantly the utility of alternatives *i* or *k* within a logit specification (Train, 2003).

Two advantages of IIA property have been conducted by (Train, 2003), the first advantage of IIA is the possibility to estimate the parameters of the model consistently on a subset of alternatives for each sampled decision maker. And since the probabilities of the subset of alternatives are not influenced by the existence of other alternatives then exclusion of alternatives out of the estimation will not affect the consistency of the estimation results. The second advantage of IIA is conducting when the analyst is interested in understanding the factors which can affect choices among a subset of alternatives and not among all alternatives.

4.4.2 Probit Model

Probit Model (henceforth, PM) is one of the most important logit family model, (Ben-Akiva and Bierlaire, 1999) mentioned that it comes from "Probability Unit" (or Probit) for normal probability unit model. Basically, the utility structure of probit model is exactly the same as that of the logit model, both of them are based on the utility maximization, however the underlying assumption of probit is that the unobserved error structure (see equation 4.1) is joint normal distribution with a zero mean and covariance matrix Ω (i.e. $U_i \sim N(0, \Omega)$). The probit model captures explicitly the correlation among all alternatives, without prior restrictions on the correlation structure in the distribution and may be correlated across choices, thus not imposing IIA. The advantages of probit model is that from its properties it can properly handle

all three limitations faced logit model, it has the flexibility to deal with random taste variation because it does not exist *iid* assumption and they allow any pattern of substitution, and it handles the correlation in the error terms (Train, 2003). Despite the advantages of using the probit model with normal distribution, it can still, in some cases, lead to strange forecasts (Train, 2003). Weeks (1997) pointed out that the difficulties in computing the probit model, due to not allowing the model to include a *priori* restriction when the correlation exists in error term distribution, requires an evaluation of the model over multidimensional integrals.

In the context of discrete choice modelling, a binary probit model was introduced by (Thurstone, 1927) and it is consistent with the utility maximization concept (Marschak, 1960). However, (Hausman and Wise, 1978; Daganzo, 2014) explained the probit model which assumes the multivariate normal distribution for unobserved error structure (covariance matrix) by allowing it to imply considerable level of estimation difficulty. The Probit approach as any other model of logit family is based on the random utility theory (McFadden, 1973). From the point of view of Munizaga and Ortúzar (1997) they considered that the probit model is a desirable and powerful tool by producing the estimation from the simulation. (McFadden, 1989; Pakes and Pollard, 1989) propose simulation methods can lead to a practical probit estimation code with the number of alternatives, possibly more than four (Bunch, 1991).

Koop (2003) pointed out that the probit model is used when the dependent variable is a qualitative variable (i.e. dummy variables 0, 1) and the outcome resulted in one or two categories. Assuming that an individual n ($n = 1 \ldots N$) should make a choice between two alternatives (0 and 1) based on the utility function, the individual makes choice one if $U_{1n} \geq U_{0n}$ and makes choice zero otherwise. In this context, the choice is based on the difference in utilities across the two alternatives as following:

$$y_n^* = U_{1n} - U_{0n} \tag{4.4}$$

Then the assumption of probit model is to consider that the differences in utilities follows the normal distribution. The econometrician analyst will not observe y_n^* directly, s/he only captures the choice made by the individual n. For the probit model, the relationship between y and y^* is:

$y_n = 1$ if $y_n^* \geq 0$ (4.5)

$y_n = 0$ if $y_n^* < 0$ (4.6)

For the choice probability function:

$$\text{Prob}(y_n=1|x_n) = \Phi(x_n' \beta) \tag{4.7}$$

$$\text{Prob}(y_n=0|x_n) = 1 - \Phi(x_n' \beta) \tag{4.8}$$

Where:

y_n is the dependent variable binary dummy (0, 1).

Φ is cumulative normal distribution function.

X_n is the observed variables.

Previously, it is mentioned in equation (3.6) that the choice probabilities are given by:

$$P_{nit} = \int_{\varepsilon} I\,(\varepsilon_{njt} - \varepsilon_{nit} < V_{nit} - V_{njt}\ \forall j \neq i)\ \phi\,(\varepsilon_n)\ d\,\varepsilon_n, \qquad (4.9)$$

Where *I (.)* is the indicator function, the choice probabilities function in (4.9) does not have a closed-form expression and must be approximated numerically (Train, 2003). Several simulation procedures and non-simulation procedures have been used in certain situations for probit models; for non-simulation procedures (Geweke *et al.,* 1997) explained a good example of probit model effectively in a small dimension of integral. However, for simulation procedure, Ruud (1996) proved general and useful approximating probit probabilities.

So, the density of ε_n, $\phi\,(\varepsilon_n)$ is written as following:

$$\phi\,(\varepsilon_n) = \frac{1}{(2\pi)^{J/2}|\Omega|^{1/2}}\ e^{-1/2\ \varepsilon'_n \Omega^{-1} \varepsilon_n} \qquad (4.10)$$

The covariance matrix Ω can depend on variables faced by decision maker *n.*(Train, 2003).

And $\varepsilon_n \sim N\,(0, \Omega)$ with $\Omega = I_j \sum$, where $j = 1 \ldots J$. *(I)* is an identity matrix (i.e. square matrix with ones on the main diagonal and zeros elsewhere) and $\sum$ is the covariance of ε_n. If Ω is a diagonal matrix[17], which is σ_{ji} are zeros for all $j \neq i$ then the ε_n are independent or uncorrelated. While in a situation that all the nonzero elements of Ω have the same value, then the ε_n are identical.

In discrete choice modelling, identification constraint is a well-known issue of the probit model. Any discrete choice model should be normalized via two things; first, utility levels are irrelevant (e.g. adding a positive constant to all of utilities with staying the results consistent regardless what the constant is) and second, normalize the scale of utility (e.g. multiplying all utilities (y_n^*) by a positive constant $\alpha > 0$ will generate the same model with the same implication for the observed choices, $\alpha y_n^* = \chi'_n(\alpha\beta) + \alpha\varepsilon_n$, in this respect, the analyst will get the equivalent model with the slop coefficient $(\alpha\beta)$ and variance ($\alpha^2\sigma^2$)). The usual approach is to normalize $\sigma = 1$, this in its turn solves the identification problem (McCulloch *et al.,* 2000). The econometricians allow α to vary across individual rather than to be fixed, in this respect, the normal distribution is imposed on α with a mean α, and a standard deviation around the mean, ζ, which differs across individual. It can be formulized as following:

[17] The diagonal matrix is a square matrix in which all elements outside the main diagonal (↘) are all zero.

$$U_{ij} = \alpha' Z_{ij} + \varepsilon_{ij} \quad (4.11)$$

$$= (\alpha+\zeta)\, Z_{ij} + \varepsilon_{ij}$$

4.4.3 Mixed Logit Model and Its Specifications

4.4.3.1 Standard Mixed Logit Model

Mixed Logit (henceforth, ML) model, also called random-parameter, stands as probably the most significant advancement in random utility discrete choice analysis (McFadden and Train, 2000). ML is a suitable model to allow unobserved heterogeneity to be included across individual decision makers and depended on their variation with observed exogenous variables (i.e. random coefficients) according to (Bhat, 2000; Garrow, 2012). The acknowledge in applying and explaining ML is to (Hensher and Greene, 2003) and also to (Train, 2003). Train employed ML model in empirical studies because its flexibility to process different desirable characteristics (e.g. ML is unrestricted to normal distribution as probit model) and also its simplicity to deal with the choice probability in the simulation process (Train, 2003). Thus, ML model has the ability to fully relax IIA assumption to get a degree of heterogeneity and avoid homogeneous preferences.

To illustrate the random parameter model, and as already indicated in this chapter (see section 3.3.2 for RUT), the general form of the utility function as mentioned in (3.1) is: $U_{nit} = V(X_{nit}, \beta_n) + \varepsilon_{nit.}$ Where $\varepsilon_{nit} \sim iid$ extreme value (Gumble). While the distribution of systematic part ($V(X_{nit}, \beta_n)$ is critical in both Bayesian and classical econometrics (Train and Sonnier, 2005). Train and Sonnier suggested transformation of normals of the utility coefficients. The partworths are defined as $g(\beta_n)$. Where $g(.)$ is transformation that depends only on $\beta n.$ The distribution of $g(\beta_n)$ is determine by the transformation. For example, many useful distribution can set up as transformations of normals, log-normal distribution is exponential form can set up to price coefficient to reversed undesirable sign for this attribute.

According to transformation of normals, the utility function is specified as:

$$U_{nit} = X'_{nit}\, g(\beta_n) + \varepsilon_{nit} \quad (4.12)$$

Where:

X_{nit} is a vector of observed variables relating to all attributes presented in the choice set.

ε_{nit} is a random error term with "extreme value" (Gumbel) distribution. Also, it is not correlated across individuals or across choices. Different models can be considered according to different assumptions for the distribution of the random error term (ε_{nit}) (Train, 2003).

β_n is a vector of coefficients represent " Part worths", " Marginal Utilities" ," Taste Weights". It is a vector of describing the preferences of the individuals (Balcombe *et al.*, 2014).

$g(\beta_n)$ is the transformation function of the utility coefficients (i.e. exponential transformation form for a given attribute coefficient can produce log normal marginal utility for that attribute) (Balcombe *et al.*, 2014).

The aim of the mixed logit analysis is to identify and estimate the coefficients (β_n) and the error term (ε_{nit}) among the observed attributes (X_{nit}). Therefore, the unconditional choice probability will be the integrals of standard logit probabilities over a density of parameters:

$$P_{nit} = \int L_{nit}(\beta_n) f(\beta_n|\theta_n) d(\beta_n) \quad (4.13)$$

Where $L_{nit}(\beta)$ is the logit probability evaluated at the vector of parameters β that are random realizations from the density function $f(\beta)$. Also, $L_{nit}(\beta)$ takes the MNL form, for a special realization of β, the ML is as following:

$$L_{in}(\beta_n) = \frac{\exp^{(V_{nit})}}{\sum_j \exp^{(V_{njt})}} \quad (4.14)$$

When probabilities in (4.13) do not have a closed expression, it must be approximated by simulation in order to get the simulated log-likelihood or maximum likelihood estimation of the parameter θ that considered the distribution of β_n. According to (4.13), Hess *et al.*, (2005a) pointed out to three issues that happened with the estimation of mixed MNL with regard to a vector of parameter of the distribution of the elements (θ_n) associated with the β_n coefficients given a random sample of observations from the population, with the assumption that the value of all of the β_n or some of them are vary in an unspecified way. The issues of the specification of heterogeneity are related to the selection of which parameters should be modelled as being randomly distributed across individuals, the choice of statistical distribution for these coefficients and the economic interpretation of randomly distributed coefficients. However, (Hensher *et al.*, 2005) mentioned that the presence of the complex choice task in the stated choice experiment defined by some factors like the number of choice situations, number of alternatives, attribute ranges, data collection methods...etc, can allow for some conditions to impose specific parameters associated with attributes of alternatives. In ML assumption, β_n is assumed to have *iid* extreme value type I distribution for the random error term. Actually, existing a *priori* distribution to the choice task can be considered an issue to represent the random taste variations across individuals (Hess, 2007). In addition, in some cases, choosing unsuitable mixing distribution in the model can influence the performance of the model. Put differently, the mis-specifying of the distribution in the model can affect not only the

performance but also the interpretation and the behaviour (Hess *et al.*, 2005a; Hess, 2007, 2005b). As a result, more attention should be required in selecting the choice distribution for the random taste heterogeneity parameters, example, for the model which is depend on the fixed taste coefficients, analysts already have *a prior* expectation that the coefficients will be gained in a negative value, so they will exclude any positive values because the model misspecification (Hess *et al.*, 2005a) while the sign–issue will become more complicated when the model deals with the random taste heterogeneity parameters.

Mixed Logit Model Specifications

Three attractive mixed logit specifications have been examined on the data set: ML model including heterogeneity scale variance; ML model including Attribute Non-Attendance (AN-A) and ML model including Importance of Ranking Attributes (IR-A).

4.4.3.2 Mixed Logit Model including Heterogeneity Scale Variance {Specification One}

For the first specification of the model, the utility of mixed logit model including the heterogeneity scale variance will be written in the following form (According to Balcombe *et al.*, (2015)):

$$U_{nit} = X'_{nit} \Lambda \, g(\beta_n) + \sigma_n \varepsilon_{nit} \qquad (4.15)$$

Where

X'_{nit} is a k x 1 vector of presented attributes used in the choice experiment.

Λ is the matrix in standard mixed logit and defined as: $\Lambda = I_k$

$g(\beta_n)$ is the transformation function of the utility coefficients (i.e. exponential transformation form for a given attribute coefficient can produce log normal marginal utility for that attribute) (Balcombe *et al.*, 2014). For this study, the transformation to the price attribute to be log-normal distribution.

ε_{nit} is the error term with extreme value (Gumbel). It is uncorrelated across individuals or across choices.

β_n is a k x 1 vector describing the preferences of individual n. and β_n takes the form:

$$\beta_n = \alpha + \upsilon_n \qquad (4.16)$$

(α) represents the mean and (υ_n) is an independently and identically normally distributes vector with variance covariance matrix Ω. The errors $\{\upsilon_n\}$ are assumed to be not correlated across individuals (Balcombe *et al.*, 2014).

σ_n the scale heterogeneity. To account the scale heterogeneity, the model in (4.15) is generalized so that the variance of extreme value error $\{\sigma_n\}$ is specified as dependent on *n.* the specification form for the scale variance is (Balcombe *et al.*, 2015):

$$\sigma_n = e^{(-\phi)} \tag{4.17}$$

Where:

ϕ is the parameter to be estimated.

4.4.3.3 Mixed Logit model including Attribute Non-Attendance (AN-A) {Specification Two}

As highlighted before, the transformation of vector β_n have been done in the scale heterogeneity. In this specification of mixed logit to capture AN-A, the assumption is that the respondents answer supplementary questions given at the end of the choice task through the DCE technique either the respondent is either a serial attender[18] or non-attender (Balcombe *et al.*, 2015). In this specification, the change will be in the diagonal of Λ (i.e. the matrix in standard mixed logit and defined as: $\Lambda = I_k$ where $\bar{\Lambda}_n = diag\ (\bar{\lambda}_1 \ldots \bar{\lambda}_k)$), the diagonal will be written in the form:

$$\bar{\lambda}_{nk} = (1 - \delta_{nk} + \bar{\rho}\ \delta_{nk}) \tag{4.18}$$

Where δ_{nk} is an indicator variable and it is one of the *n* individual is considered as non-attender of attribute *k.*

$\bar{\rho}$ is assumed that is bounded in the interval range [0,1], when $\bar{\rho} = 0$ implies that a non- attender ($\delta_{nk} = 1$) has zero marginal utility value for an attribute that s/he does not attend. Whereas $\bar{\rho} = 1$ implies that no difference between the distribution of the marginal utility of the attender and non- attender. If $\bar{\rho}$ is small, then the marginal utility will approach zero. This specification has been supported by (Scarpa *et al.*, 2010).

Then from the (4.15), the utility function will be written in a new form:

$$U_{nit} = X'_{nit}\ \bar{g}\ (\beta_n) + \sigma_n\ \varepsilon_{nit} \tag{4.19}$$

Where $\bar{g}\ (\beta_n) = \bar{\Lambda}\ g\ (\beta_n)$

4.4.3.4 Mixed Logit model including Importance of Ranking Attributes (IR-A) {Specification Three}

Follow- up questions after the choice cards and nonattendance question are including the ranking question from highest importance to the lowest importance of the attributes in the

[18] A serial AN-A is when respondents are asked to record the ignored attributes in the whole sequence of choice cards in their questionnaire, then this form is called "serial AN-A" due to extends to all the choice performed by the same respondent (Scarpa *et al*, 2010).

survey online. For this specification, once again the change is becoming in the diagonal of Λ (i.e. the matrix in standard mixed logit and defined as: $\Lambda = I_k$ where $\tilde{\Lambda}_n = diag\ (\tilde{\lambda}_1 \ldots \tilde{\lambda}_k)$), the diagonal re-written in the form (Balcombe *et al.*, 2015):

$$\widetilde{\lambda_{nk}} = (1 - \tilde{\rho}) + \tilde{\rho}\ \frac{(\mathcal{R} - \mathcal{Z}_{nk})}{\mathcal{R}-1} \qquad (4.20)$$

Where $\tilde{\rho}$:is estimated in the range [0, 1]; R: is the number of attributes in DCE; $\mathcal{Z}_{nk}$: is the rank score given to attribute *K* by individual *n.*

When $\tilde{\rho}$ approach zero then the ranking data is not important in determining the mean and variance of the coefficients. While, $\tilde{\rho}$ is one value then the lowest ranked attribute will have zero marginal utility. When $\tilde{\rho}$ is close to one, that means the importance of ranking attribute data is providing important information with regards of the model performance (Balcombe *et al.*, 2015). When the mean rank of attribute is high then $\widetilde{\lambda_{nk}}$ is big in the estimation and the lower impact on α.

Then from the (4.15), the utility function will be written in a new form:

$$U_{nit} = X'_{nit}\ \tilde{g}(\beta_n) + \sigma_n\ \varepsilon_{nit} \qquad (4.21)$$

Where $\tilde{g}(\beta_n) = \tilde{\Lambda}_n\ g\ (\beta_n)$

4.3.3.5 Concept of Willingness to Pay

Willingness To Pay (henceforth, WTP) is the application of Discrete Choice Experiment (DCE) which allows measuring the consumer preference to change one attribute-lower level for other higher level of the same attribute. It can be calculated as the ratio of the coefficient of attributes to the coefficient of payment:

WTP = — (coefficient of attributes *X*) / (coefficient of payment) (4.22)

Over many years, the measurement of WTP in consumer research area have focused on measure WTP for a given attributes of a particular consumer product. However, the vast majority of these studies have empirical examination and insight views on a particular market and attribute concerned. Some studies consider that WTP measure is clearly an important policy tool applied in DCE for many reasons; first, providing lots of information for the policy makers can help in evaluating how much consumer's value goods and services, especially for the pricing of these goods and services. Second, measuring WTP can be more fruitful and warrant estimation priority for making comparisons and rankings between goods and services (Balcombe *et al.*, 2009).

Different ways have been discussed to estimate WTP measures, one way to derive WTP is by asking the respondents directly how much they are willing to pay for a specific good or service. This way has one issue, that is the difficulty of having answers about direct questions of WTP, especially when the respondents have incentives to answer strategically (Ryan, 2004; Carson *et al.*, 2001). Another way to derive WTP estimation whether in SP or RP, is by calculating a ratio of the attribute coefficients to price attribute coefficient as in (4.22) (Train, 2003).

Train and Weeks (2005) and Sonnier *et al.*, (2007) present WTP estimation into two spaces; preference space and WTP space. They used hierarchical Bayes for the estimation of mixed logit model with stated preference data on the choice of cars related to different fuel systems and cameras to make a compassion of the performance of models in preference space and WTP space. The results for two previous studies are matched and similar; they found that the models in preference space fit the data better than the models derived in WTP space. However, Scarpa *et al.*, (2008) used revealed preferences data on site choice in the Alps to compare models in both preference space and WTP space. They estimate models using maximum simulated likelihood and hierarchical Bayes and then derived consumers' WTP; their results conclude that WTP space emerges more realistic results and no need to trade- off between WTP estimation and model fit to data. The specification of WTP space can also provide a natural choice when the analyst can control the distribution of marginal WTP.

Balcombe *et al.*, (2009) used mixed logit model in Bayesian approach to derive consumers' WTP on bread produced with reduced level of pesticides to improve the environmental quality. They employed data generated from choice experiment. Their results provide strong evidence that WTP space estimation is stable in their study unlike other previous studies which found that WTP space is not stable.

4.5 Bayesian Econometrics Approach

In this part of the chapter, our acquaintance with Bayesian Econometrics concepts are briefly explained through Bayesian probability theory (The Bayesian toolkit: Prior, Likelihood, Posterior). Bayesian model comparison is involved. Finally, the simulation methods such as MCMC – Gibbs Sampling and Metropolis Hastings- are demonstrated.

4.5.1 Bayesian Probability Theory (or Bayes Theorem)

Bayes' theorem is placed at the core of the Bayesian paradigm where the theory provides a mathematical framework for performing inference, or reasoning, using probability. Bayesian inference handle with probability term and parameters of model in different way of the

traditional classical[19] inference does. Judge *et al.,* (1985) pointed out that the inference of traditional classical analysis focus on two main points; first, estimators and test procedures are evaluated in terms of their properties in repeated samples and second, the probability of an event is defined in terms of the limit of the relative frequency of that event. In other words, the classical methods assume that unknown model parameters are fixed constants and the data are fundamentally random (Marin and Robert, 2007), the probability is defined by assigning limit relative frequencies. In a sense, the probability can be considered objective and there is no probabilistic statements about parameters because they are fixed. Thus, in classical analysis the data are supposed to be the result of a probability measure determined by some population parameters. However, in Bayesian analysis the probability of individual's preferences among options are based on a state of belief (i.e. "degree of belief")[20] which that individual attaches to the uncertain events forming part of the definitions of the options (Bernardo and Smith, 2001). The probability of an event is given by an individual's belief in how likely or unlikely the event is to occur. This belief may depend on quantitative and/or qualitative information, but it does not necessarily depend on the relative frequency of the event in a large number of future hypothetical experiments (Judge *et al.,* 1985). Since the technical level of Bayes' theorem provides "uncertainty accounting", the uncertainty of unknown parameters value can be formalized by giving a probability density function or a discrete probability function (Judge *et al.,* 1985). In this regard, the Bayesian inference offers an alternative approach by assuming that the data are fixed and treats the model parameters as random variables. According to that the probabilities are considered subjective and the probabilistic term about the parameters is included in the model.

In the subjective sense of Bayesian paradigm, the likelihood function of observed data is combined with prior information on the parameters of interest, in order to produce a posterior probability measure and this is called "Bayes' theorem" (León and León, 2006). Thus, the parameters to be estimated are always conditional on the observed data, and can be revised as new data comes out.

The models in Bayesian approach are naturally concerned with inferences dealing with a set of parameters $\theta = (\theta_1, \ldots\ldots \theta_d)$, where d is the dimension or the region of the parameters space, that includes uncertain quantities, whether fixed or random effects, hierarchical parameters, unobserved indicators variables and missing data (Gelman and Rubin, 1996).

[19] "Classical Inference" or "Frequentist Inference".

[20] The probability of an event is based on the degree to what extent you believe the event is true.

Based on a theoretical standpoint, Bayesian rules of probability express in terms of a random vector of unknown parameters (θ) conditional on the observed data (y) (i.e. the conditional probability of θ given y). The joint probability density function P (θ |y) is a product of the prior distribution[21] P (θ) and the sampling likelihood distribution[22] P (y| θ) as the following statement:

$$P(\theta|y) \propto P(\theta)\, P(y|\theta) \tag{4.23}$$

Bayes theorem simply states that the joint density is equivalent, for either direction of conditionality[23]:

$$P(\theta|y)\, P(y) = P(y|\theta)\, P(\theta) \tag{4.24}$$

In fact, having observed data y, Bayes theorem is used to determine the distribution of θ conditional on y. considering the following probability statement: (Bayes, 1763)

$$P(\theta|y) = \frac{P(y|\theta)P(\theta)}{P(y)} \tag{4.25}$$

$$P(\theta|y) = \frac{P(y|\theta)P(\theta)}{\int P(\theta)\, P(y|\theta)\, d\,\theta} \tag{4.26}$$

Where:

P (θ) is a prior distribution.

P (y| θ) denotes likelihood function of set of observations **y** given by unknown parameters θ.

P (y) is a marginal likelihood of data (y)[24]. (The evidence).

P (θ |y) is a posterior distribution of θ, and it is considered the object of all Bayesian inference.

Even though the marginal likelihood of data, P (y), is important quantity playing a central role in some approaches such as Bayesian model choice for the model comparison, we can ignore P(y) in the posterior derivation (Koop, 2003). It is not relevant to a function of θ, therefore, it will not give any useful information about the inference of value of θ. ignoring P(y), and then we get back to equation (4.23). The following figure shows the Bayes' theorem.

---

21 The prior degree of beliefs about the parameter must be reflected by researchers in a prior distribution P (θ)

22 The likelihood function is **Not** a *pdf (i.e. pdf* is probability density function), whereas the prior and the posterior are *pdf(s)*. In other words, the prior information enters the posterior *pdf* via the prior *pdf*, while the sample information enters via the likelihood function. (Zellner, 1996) "An introduction to Bayesian inference in Econometrics".
Indeed, the probability density function (*pdf*) or mass function of a random variable X has the formula: **{Kg(x)}** where **K** is a constant (the purpose of K is to make the function integral to one. However, a family of distributions is recognized from its kernel, then it is suitable to delete the constant part when assuming the probability distribution), and **g(x),** is called the kernel of the function. Lancaster (2004).

23 For more details. See "Bayesian Econometrics", Gary Koop (2003).

24 Where $P(y) = \sum P(\theta)\, P(y|\theta)$ {in the case of discrete θ and the sum is over all possible values of θ}.
OR $P(y) = \int P(\theta)\, P(y|\theta)\, d\,\theta$ {in the case of continuous θ}.

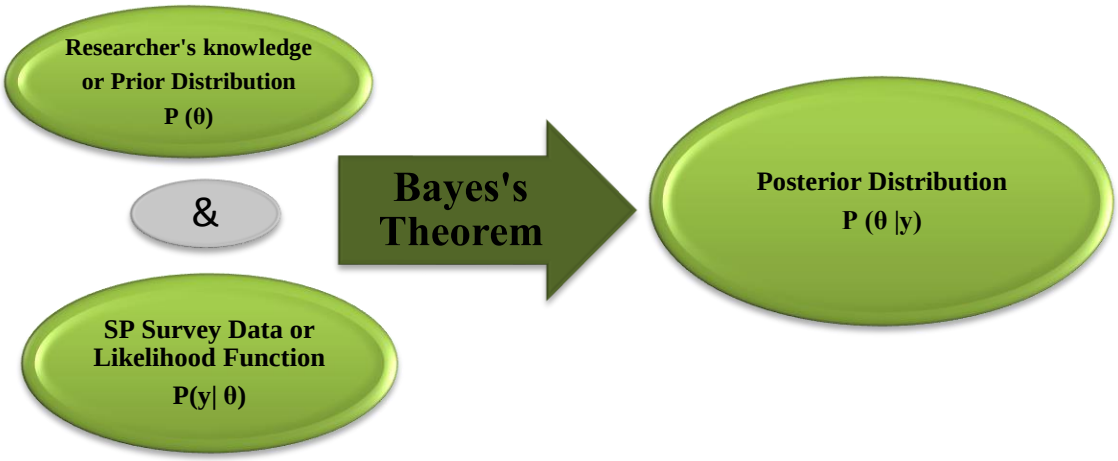


Figure 4.2: Bayes' theorem.

Any structures of the posterior distribution are acceptable for the inference of Bayesian approach such as; moments, quartiles, highest posterior density regions…etc (Gilks *et al.*, 1996).

From a theoretical framework, Bayes' theorem can reflect the best approach for updating the prior researcher's knowledge in the light of further achieved data evidence for a rational individual (León and León, 2006). However, practically, simulation techniques have been developed to enable estimation of posterior distribution involving flexible and tractable integrals. The posterior distribution can be computer-generated via Markov Chain Monte Carlo (MCMC) methods, such as Metropolis–Hastings and Gibbs sampling algorithms. (See section 4.5.6)

As mentioned earlier that Bayes' theorem include three toolkits: Prior, Likelihood, Posterior. Briefly, the next subsections include explanations of these concepts separately.

4.5.2 The Prior *P (θ)*

The prior distribution is a key source of Bayesian inference. It describes the researcher's experience, beliefs and information available about uncertain parameters θ, before seeing any observation from data collection set $P(y|\theta)$. At this point, the prior distribution represents unknown parameters combined with likelihood distribution of our data set to yield the posterior distribution. Getting posterior distribution of parameters θ can be used for further implication of decision making process (Gelman *et al.*, 2014).

In the context of Bayesian inference, setting up the prior distribution for any application is considered the primary focus for criticism of Bayesian inference. Choosing the prior should

meet the basic level of reasonableness in a manner that describes the researchers' beliefs (Dorfman, 1997). The prior should have also slight effects on posterior inferences (Gelman *et al.*, 2014). and must be chosen wisely (Robert *et al.*, 2010). According to Gelman *et al.*, (2014) in terms of selecting a reasonable prior, he mentioned two main points should be taken into account to have less effect on posterior distribution; "well-identified parameters" and "large sample sizes", the former is about the sensitivity analysis of model under different prior distributions. In other words, no certain prior does fit for all cases, thus, different classifications of prior distributions are considered by researchers, while the latter has an important effect on the posterior in case of having a small sample size or have indirect information about the parameters of available data set. Robert *et al.*, (2010) point out that computational practical prior distribution would be more worthwhile and suitable rather than subjective[25] prior belief.

Since the prior distribution has a vital ingredient in a majority of applications used in Bayesian inference, we briefly address different categories of prior distributions. Basically, an important division can be made between **informative** prior and **non-informative** prior distribution (the former is also called "traditional informative prior" or "weakly informative prior" or in a special case "uniform prior". The latter one is also called "conjugate" or "hierarchical" or "reference" or "objective" or "Laplace" or "Invariant" or "Jefferys" or "vague" or "diffuse."), bearing in mind, all these priors are treated in different ways and they are not equal in terms of the form of prior. In many situations, to select a sensible prior distribution is quite delicate in a case of missing some important prior information. Since the selection of the prior distribution has a significant impact on posterior inference, the selection should be given the utmost care. Therefore, in Bayesian analysis, a rigorous prior distribution does request to be well-justified.

4.5.3 The Likelihood $P(y \mid \theta)$

The Likelihood $P(y \mid \theta)$ simply contains the observed data delivered by the sample. In formal contexts of econometrics, two names of observed data given by parameters θ, $P(y \mid \theta)$, have been clearly noticed. The first name is a "pdf of (Y) given θ"; it means the probability density function of the potential data estimated at the point (y), conditional on parameter θ (where $\theta \in$

[25] According to Poirier (1995), he points out that the degree of belief (i.e. Subjective) represents an individual's personal assessment, while the logical information reflect "rational and unique "degree of belief introduce by a certain frame of evidence a degree-of-belief. In both, the personal and logical, the probabilities are conditional on the degree of belief.
Generally, two types of priors can be referred, *subjective prior* reflects the personal opinion and beliefs, and *objective prior* is priors chosen to let the data (i.e., likelihood) dominate the posterior distribution, and hence inference. These are generally determined based on the sampling model in use.

Θ). However, the second name is when (y) represents the actual gathering data then the likelihood is called as "likelihood function (of θ)" and denoted as ℓ (θ; y) which means the likelihood is a function of (y) with θ as the parameter (Lancaster, 2004). In Bayesian approach, the inference conforms to the likelihood principle, for example, if we have two models with probability $P(y \mid \theta)$ with the same likelihood function, then they would have the same inference for θ.

Three concerns should be borne in mind when likelihood is constructed; first of all, in the line of economic theory, the researcher should build the economic model which is capable of answering the question of economic interest and to persuade others of the research results and give some advice about choosing the likelihood in a consistent way. Secondly, the likelihood must fit the way in which the data were obtained in terms of choosing a suitable data (e.g. choosing a sample out of the whole population). Finally, in the light of the probability theory, the theory provides the researcher with a wide range of distributions according to each case study (e.g. variables whose natural sample space might be assigned normal distributions; variables that are naturally non-negative might be assigned gamma distributions; variables that can take non-negative integer values are assigned Poisson distributions and so on. (Lancaster, 2004).

4.5.4 The Posterior $P(\theta \mid y)$

The posterior P (θ | y) is the probability density function which reflects the researcher's belief about the parameters θ depending on prior beliefs, where these beliefs are included in the likelihood and the evidence (Lancaster, 2004). In applied Bayesian analysis, the posterior is the target of our task and it is parallel to estimated values of θ with estimated standard errors in classical econometrics. Essentially, the kernel of the posterior is the main purpose of the Bayesian inference and plays a curial role in interpreting the results where it provides complete information about (θ) as mentioned earlier.

4.5.5 Bayesian Model Comparison or Bayesian Model Selection

In Bayesian framework, the estimation of model parameters and uncertainties are conducted by quantifying the content of the information related to the data set and the prior. Bayesian inference is based on obtaining the posterior probability density function, which combines both the data information, expressed in terms of a likelihood function, and the prior information, which is expressed in terms of the prior knowledge. A prior distribution is chosen as a uniform distribution and it almost never choses an improper prior because the distribution is marginalized over the parameters and in this respect the improper prior is not useful to be

adopted. In fact, the computation of the posterior distribution does require more effort in some cases of complex models (Han and Carlin, 2011). However, some solutions have been found by (Carlin and Chib, 1995; Chib, 1995; Green, 1995; Meng and Wong, 1996; Sinharay and Stern, 2002) to overcome the difficulties facing the estimation of posterior probability. In addition. (Barbieri and Berger, 2004; Meyer and Laud, 2002) found several ways to assess models such as predictive model selection.

Before proceeding to further explanation about the model selection, it is worth mentioning the fact that building any development for any model to be fit and comparable is never going to be the "true model" or the "best model" which generates the data we observe. Put differently, the set of models is misspecified. (Box, 1976) said "Essentially, all models are wrong, but some are useful." And the model comparison might be seen as a tool of approximating, rather than identifying, full reality (Burnham and Anderson., 2003) pp. (20–23). In other words, Bayesian analysis is designed, in fact, to have identification of the true model, this in its turn argues with Box's quote, because we already know that all the models are false (i.e. the probability is zero). Actually, the interpretation of the posterior probability that the true model given the data, even though we already know that all the models are false priori (Gelfand, 1996). The criticism for this point is sorted out by finding the model that is approximately true and then the posterior probability is used to help in comparing the relative merits of the models (Wasserman, 2000).

In Bayesian paradigm, an area of particular interest is **Bayesian model comparison** (i.e. selecting an appropriate model parameterization). The point here is to compare competing models after estimating the parameters of the model. The model comparison, among others, helps in getting the best model in terms of certain preferences such as maximizes the posterior probability given the data and other information (Congdon, 2007). As Koop (2003) points out that the econometrician are not only interested in learning about model parameters but also comparing different models to choose the best. Suppose that $\boldsymbol{m}$ represents different models under certain consideration, $\boldsymbol{M_i}$ where $\boldsymbol{I = 1, 2\ldots m,}$ which all seek to explain $\boldsymbol{y}$. $\boldsymbol{M_i}$ depends on parameters $\boldsymbol{\theta_i}$, also the numbers of the parameters in the models are not the same. Therefore, the posterior distribution for the parameters calculating using $\boldsymbol{M_i}$ is:

$$P\ (\theta_{\ i}|y, M_i\ ) = \frac{P(y|\theta_{\ i}, M_i)P\ (\theta_{\ i}|M_i)}{P\ (y|M_i)} \qquad (4.27)$$

Where: $\boldsymbol{P\ (y\ |\ \theta_{\ i},\ M_i)}$ represents likelihood function. $\boldsymbol{P\ (\theta_{\ i}\ |\ M_i)}$ denotes the prior distribution and $\boldsymbol{P\ (y|\ M_i)}$ is called marginal likelihood or the evidence[26]. Obviously, Bayesian model

[26] Also called "integrative, or predictive likelihood" in different terms.

selection is the integral portion of Bayesian estimation (Gelfand, 1996; Raftery, 1996; Wasserman, 2000), in this respect, there are several strategies and methods to get the best competing model among others (Berger, 2013; Berger and Pericchi, 1996; Carlin and Louis, 2008). These strategies include: Bayes Factors, Posterior Model Probabilities, Bayesian Information Criterion (BIC), Posterior Odd Ratio, Decision Theoretic Approaches (DT methods), Model Averaging, Akaike Information Criterion (AIC) … etc (Koop, 2003; Posada and Buckley, 2004).

In the light of Bayes' theorem, Koop, (2003) suggests to derive the probability statement to express what we do not know about the model if it is correct or not, on condition of what we have (i.e. data), then *Posterior Model Probability* could be one way to express the degree of support for $\boldsymbol{M_i}$, using Bayes' rule of ***A*** and ***B***[27]***: P(B|A) = P(A|B) P(B) / P(A)*** and putting $\boldsymbol{M_i}$ instead of ***B,*** and ***Y*** instead of ***A,*** the formula is written as: $\boldsymbol{P(M_i \mid y) = P(y \mid M_i)\, P(M_i) / P(y)}$ **.**

Where: $\boldsymbol{P(M_i)}$ is the prior model probability.

$\boldsymbol{P(y \mid M_i)}$ is the marginal likelihood; and it is calculated using equation (4.27) and some manipulations (Koop, 2003). By conducting the integral for both sides of equation (4.27) we rewrite the marginal likelihood:

$$P(y \mid M_i) = \int P(y \mid \theta_i, M_i)\, P(\theta_i \mid M_i)\, d\,\theta_i \qquad (4.28)$$

As mentioned before, it is hard to calculate the marginal likelihood, $\mathbf{P}\,\boldsymbol{(y \mid M_i),}$ directly. So, to compare two models ***i***, and ***j***, it might be useful to use the ***Posterior Odd Ratio***, it is the ratio of their posterior model probability as following:

$$\mathrm{PO}_{ij} = \frac{P(M_i \mid y)}{P(M_j \mid y)} = \frac{P(y \mid M_i)\, P(M_i)}{P(y \mid M_j)\, P(M_j)} \qquad (4.29)$$

Where, it is considered that $\boldsymbol{P(y)}$ is the same for both models. In a case of having two equal priors distributions (i.e. $\boldsymbol{P(M_i) = P(M_j)}$) then the *prior odd ratio* sets up to one and the best model is the one chosen most frequently (i.e. with highest posterior probability of being selected) (Congdon, 2007). Consequently, and in terms of having two equal prior distribution and equal to one, the *posterior odd ratio* becomes the ***ratio of marginal likelihoods***[28] and this is what it called "***Bayes Factor***" (Kass and Raftery, 1995) and it is:

[27] Bayes' rule of probability ***A*** and ***B: P(B|A) = P(A|B) P(B) / P(A)*** where: A, B are random variables**.**

[28] Rigby, *et at*, (2009) mentioned that in a very special case the posterior odds ratio and the ratio of marginal likelihoods for two model is equal to each other.

$$\mathrm{BF}_{ij} = \frac{P(y|M_i)}{P(y|M_j)} \tag{4.30}$$

Where: ***P (y| Mi)*** is marginal likelihood for model ***(i)***, ***P (y| Mj)*** is marginal likelihood for model ***(j).*** Actually, the marginal likelihood, ***P (y| Mi),*** is the measure of how good ***(Mi)*** predicted the observed data ***(y)*** that is relevant to compare ***(Mi)*** with others models. The highest marginal likelihood of the model has the highest support compared to other models with taking into consideration the observed data (Geweke, 1999). The ratio of marginal likelihoods or Bayes factors measure the change in the support of the data in favour of one statistical model relative to another model (Suchard *et al.*, 2003). Bayes factors in Bayesian statistical analysis are also playing the same role to *p*-values in classical statistics (Penny *et al.*, 2006). However, Raftery, (1995) argues that by asserting that *p*-value is somehow misleading the results for large samples size, the reason of misleading results that Fisher originally suggested the level of significant (α) to be 0.05 or 0.01 depend on his experience for a small size of agriculture experiments (i.e. between 30-200 observations) and this is not working well with a large sample size. In fact, the Bayes factors can handle this problem by providing the Bayesian principled way to do this.

Joining equations (4.27) & (4.28), then the marginal likelihood is written as:

$$P\ (y|M_i) = \frac{P\ (y|\theta_i, M_i) P\ (\theta_i|M_i)}{P\ (\theta_i\ \big|\ y, M_i\ )} \tag{4.31}$$

Where θ_i is a Bayesian point estimate of posterior density distribution. Common point estimators are: posterior mean[29], posterior median[30] and posterior mode[31] (Hoff, 2009). Essentially, the posterior mode is selected to be estimated for the reason that it ensures numerical stability (Chen *et al.*, 2012), as an alternative estimate to posterior mode is the posterior mean, both of them (i.e. the mode & mean) are useful while the posterior mean is chiefly commonly used and has its natural interpretation. Hamilton, (1994) p. 362, illuminates different situations of approximating the posterior mean and the posterior mode. If the posterior distribution of θ is symmetric about its mode, then the posterior mean is the same as the posterior mode, otherwise, they are different. However, if the mean and mode are different, in

[29] Posterior mean is the centre of mass of distribution. And it is: E [θ| *x*] =$\int \theta f(\theta|x) d\theta$. (If θ is continuous) and E [θ| *x*] = $\sum \theta f(\theta|x)$. (If θ is discrete).

[30] Posterior median the value of θ in the middle of the distribution. It is: $F^{-1}_{\theta|x}(0.5)$ where $F_{\theta|x}$ is CDF corresponding to the posterior density: (i.e. $F_{\theta|x}(\theta) = \int_{-\infty}^{\theta} f(\theta|x) d\theta$.

[31] Posterior mode is the most likely probable value of θ. It is: max $_{\theta}$ *f (*θ| *x)* and this is the point at which the density is highest.

terms of having a quadratic loss function, then the posterior mode will typically approach the posterior mean when the sample size increases (DeGroot, 2005). Moreover, there is one option to use the posterior mode rather than the mean of the posterior distribution, it happened when the Bayesian estimation of θ aims to be the value that maximizes $f(\theta|\, x)$, in other words, if the estimation aims to reflect where the central mass of the posterior distribution lies than where the posterior is highly skewed, then the posterior mode is a better choice than the posterior mean.

In the context of model comparison, there are many ways to achieve the posterior distribution (Gelman *et al.*, 2014; Carlin and Louis, 2008) while clearly (Chen *et al.*, 2012) have been used MCMC approach as very suitable simulation methods to approximate the posterior distribution. on one hand, he mentioned that MCMC methods can help to obtain a certain location in the posterior distribution tail, whereas, on the other hand, the comparison of the posteriors might not be computationally easy to be captured; the reason of that because it is highly unlikely to have large numbers of MCMC draws being placed in the posterior tails, or in particular situations, θ_i may be placed outside the range of MCMC observations, as a result, the estimation of the posterior leads to unreliable and incorrect estimates (Chen *et al.*, 2012). Instead of that, it might be more effective to compute the natural logarithm of marginal likelihood (i.e. ln [p (y | M_i]) more than computing the marginal likelihood directly.

Everitt *et al.*, (2015) discussed the difficulties of using MCMC methods in terms of "intractable likelihood functions"; he has explained that the difficulties in performing the Bayesian inference in models are not only related to the posterior estimation issues but also related to the likelihood P (y| θ) evaluation. For example, what it makes the likelihood difficult to approach, first, using big data sets where the likelihood contains a product of a large number of terms. Second, the presence of a large number of latent variables, according to that the likelihood is known as a high dimensional integral (i.e. P (y| θ) =$\int p(y, x|\theta)dx$). Third, when the estimation of likelihood has INC[32] (i.e. Intractable Normalising Constant). All these issues have been solved by applying different methodologies, and the approximation is introduced into either the likelihood under consideration, or the Monte Carlo simulation algorithm used to simulate from the posterior.

[32] In the context of Bayes theorem, the likelihood augment the prior distribution to yield a posterior distribution, i.e.:
p (θ | y) = $\frac{1}{p(y)}.p(y|\theta\ ).p(\theta\ )$ = (normalizing constant). $p(y|\theta\ ).p(\theta\ )$ = constant. likelihood .prior
the constant p(y) normalizes $p(y|\theta\ ).p(\theta\ )$ to one, this is can be obtained by calculating the integration:
P (y) =$\int_\theta p(y|\theta\ ).p(\theta\ )\, d\theta$.

In the existence of non-informative prior can make some troubles for the Bayesian analysis, the estimation of marginal likelihood turns out to be indeterminate especially for using a diffuse prior (Poirier, 1996), and using this kind of prior can affect the posterior odds ratio and make the marginal likelihood estimation starts to support the most parsimonious model which include a very few parameters (Koop, 2003). However, the informative prior makes the marginal likelihood support the best model which fits the data whether parsimonious model or not. Practical difficulties are found in Bayesian inference and it is about the estimation of marginal likelihood in high-dimensions parameters space, (Gilks *et al.*, 1996) considered that the numerical evaluation of the integration is difficult and inaccurate in greater than 20 dimensions, and the analytic calculation is conducted into two approaches, such as "Laplace approximation"[33] (Kass *et al.*, 1988) and MCMC simulation method. Raftery (1996) outlines several importance methods to estimate the marginal likelihood[34]. A very common method due to (Gelfand and Dey, 1994) is worth using for nested and non-nested models comparison and available to compute in a modern automatic software (Koop, 2003). The Gelfand- Dey method is produced from the fact that used the inverse of marginal likelihood for the model, M_i , based on parameter vector (θ), and can be recorded as $E[g(\theta) \mid y, Mi]$ for a specific choice of g(.) (Koop, 2003) p 105. The (Gelfand and Dey, 1994) formula for the probability density function $f(\theta)$ [35] with support contained in the support of the posterior, is written for the model M_i on the parameter space Θ as follows:

$$\mathrm{E}\left[\frac{f(\theta)}{p(\theta|M_i)p(y|\theta,M_i)}\middle|y, M_i\right] = \frac{1}{p(y|M_i)} = \mathrm{p}(y|M_i)^{-1} \tag{4.32}$$

Where $P(\theta|M_i)$ denotes the prior distribution and $P(y|\theta, M_i)$ denotes the likelihood distribution. Since the prior and the likelihood are known, then MCMC application has been used to approximate the inverse of the marginal likelihood, $\mathrm{p}(y|M_i)^{-1}$. The accuracy of Gelfand- Dey methods is based on the choice of the tuning function $f(\theta)$, hence, the selection of the $f(\theta)$ should have more attention by the investigator (Koop, 2003). Geweke (1999) discussed that the ratio $\frac{f(\theta)}{p(\theta|Mi)p(y|\theta,Mi)}$ must be bounded under the principle of asymptotic theory. Put differently, it must be finite for every possible value of θ (Koop, 2003). To make sure that the method is achieved, Geweke (1999) suggests a flexible practical way to select an efficient $f(\theta)$, which

[33] A version of the Laplace method is called "Laplace – Metropolis" method has been proposed by Raftery (1996) & Lewis & Raftery (1997), where the posterior mode and Hessian matrices are estimated from the output of the posterior simulation.

[34] Raftery *et al*, (2006) called the marginal likelihood or "The integrated likelihood" or "the normalizing constant ".

[35] Also called "tuning function".

including $f(.)$[36] to be normal density with cutting off the tails. The reason for cutting off the tails is making the ratio $\frac{f(\theta)}{p(\theta|Mi)p(y|\theta,Mi)}$ easy to be finite out of tails of the normal density. Therefore, chopping the tails helps by setting $f(\theta)$ to zero in the parameter space $\widehat{\Theta}$ (Koop, 2003). Let $\widehat{\Theta}$ and $\hat{\Sigma}$ be estimates of the posterior mean $E[\theta|y, Mi]$ and the posterior variance $var(\theta|y, Mi)$ obtained from the posterior simulator, hence for a probability, P $\in (0,1)$, let $\widehat{\Theta}$ represent the support of $f(\theta)$ which is define by

$$\widehat{\theta} = \{\theta: (\hat{\theta}:\theta)' \widehat{\Sigma^{-1}} (\hat{\theta}:\theta) \leq \chi^2_{1-p}(\kappa)\} \quad (4.33)$$

Where: $\chi^2_{1-p}(\kappa)$ is the (1-p)th percentile of the Chi-squared distribution with k degree of freedom and k is the number of elements in θ. A better behaviour of the ratio $\frac{f(\theta)}{p(\theta|Mi)p(y|\theta,Mi)}$ over the region $\widehat{\Theta}$ could be by using smaller p values because many draws would not be related to the marginal likelihood estimation, but at the same time may lead to a greater simulation error (Geweke, 1999; Koop, 2003). Working to decrease simulation error, the $f(\theta)$*"tuning function"* could be set up equal to the priors distribution, in which case the inverse of marginal likelihood is reduced to the harmonic means of likelihood values, the simplest estimator. However, (Raftery, 1996; Raftery *et al.*, 2006) argue that the disadvantage of harmonic mean estimator is its computational instability and might have infinite variance across simulations. Two approaches have been investigated to cope with the stability of the harmonic mean estimator; the first approach is to reduce the parameter space by modifying estimator includes the harmonic mean of heavier – tailed densities, the results in this approach are developed to be stable and finite variance estimators, while the second approach depends on modelling the posterior distribution of the log-likelihood by using a shifted gamma distribution, the results here are worked well by estimating a true and effective number of parameters (Raftery *et al.*, 2006). The Gelfand- Dey method is considered difficult to achieve in terms of dealing with models which have latent variables. The reason has been proposed by (Geweke and Keane, 2001), they mentioned that the latent variables and parameters could be integrated out of the marginal likelihood, and this in its turn formed a challenge especially when the estimation conducted under high –dimensional integrals.

Indeed, having different models and attempting to compare them in terms of using posterior model probabilities or posterior odds ratio or Bayes factors are useful and worth. Bearing in mind that all these methods have to calculate the marginal likelihood (Koop, 2003). Ultimately,

[36] $f(.)$ is a generic density function of the tuning function.

the goal of calculating the posterior distribution is often estimation, prediction or decision making, rather than the models comparison *per se* (Raftery, 1996).

4.5.6 Simulation Based on Bayesian Analysis

4.5.6.1 Markov Chain Mote Carlo (MCMC) Algorithm

Markov Chain Monte Carlo (MCMC) is essentially a method of posterior simulation[37] in Bayesian econometrics inference attempting the integration using Markov chains and sometime it is used in frequentist econometrics. The main goal of using MCMC is to approximate the posterior distribution of the parameters. It needs to get the integration[38] over possibly high-dimensional probability distributions (i.e. to integrate the posterior distribution of model parameters given the data) to obtain the inference about the model parameters (Gilks *et al.*, 1996). However, Chib (1996) has mentioned that MCMC simulation is difficult to apply in complex and high- dimensional parameter space. He suggested that MCMC simulation could be used without including "normalizing constant" of the target density, which has a curial role in Bayesian inference as mention earlier (see page 78). It could be also possible to achieve MCMC simulation with some models which have intractable likelihood function, in this respect, the posterior (target) distribution is augmented by latent variables and MCMC simulation will be functioned on a space larger than the parameter space, this strategy is call "data augmentation"[39] (Chib, 2001) (p: 3599).

Indeed, many procedures have been developed in terms of simulation techniques to assist in the estimation of posterior distribution in complex and intractable integrals. The first such methods has introduced by (Metropolis *et al.*, 1953; Hastings, 1970), is known as the **Metropolis-Hastings (M-H)** algorithm. In M-H method, the next point of Markov Chain is produced from a suggestion density at the current point and then accepted or rejected related to the target

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[37] Posterior simulation methods are used extensively in details on, Gelman, *et al* (2014); Geweke (1999); Carlin and Louis (2000); Chib (2001); Geweke and Keane (2001); Koop (2003); Lancaster (2004); and Geweke (2005). The most important applications of posterior simulation are Monte Carlo integration, importance sampling, Gibbs sampling and Metropolis- Hastings algorithm.

[33] MCMC methods is consisting of two parts, Monte Carlo integration and Markov Chain process. first part is about the **Monte Carlo integration**, which evaluates $E[f(X)]$ by drawing samples$\{ X_t, t = 1,\ldots,n\}$ from posterior distribution then approximating : $E[f(X)] \approx \frac{1}{n} \sum_{t=1}^{n} f(Xt)$. Where, the population mean of *f(X) is* estimated by a sample mean (Gilks *et al,* 1996). When the samplers (Xt) are independent, laws of large number make sure that the approximation could be precise and accurate by increasing the size of the sample n. (n is under the researchers control). Generally, it is difficult to achieve (Xt) independently from the posterior distribution. So it can be generated by any process allows drawing samples throughout the support of posterior distribution in the correct proportions. To do that, Markov Chain can help having the posterior distribution as its stationary distribution (this is the second part). Then both of two parts form Markov Chain Monte Carlo (MCMC).

[39] Data Augmentation is considered the strategy of enlarging the parameter region to be available to include the missing data or latent variables (Chib, 2001).

density at the candidate point (Chib, 1996). While the second method is considered a special case of M-H algorithm and it called **Gibbs Sampling**. Geman and Geman, (1984) introduced Gibbs sampling methods and (Tanner and Wong, 1987; Gelfand and Smith, 1990), they extend the concept of this methods. In Gibbs sampling, the next value of Markov Chain is achieved by the sampling subcomponents of a random vector from a sequence of full conditional distributions (Chib, 1996).

According to Koop *et al.*, (2007), he explained that the main strategy using the iterative simulation methods generally to create a series of draws "parameters chain" such as $\theta_0, \theta_1, \theta_2,\ldots$ which converge to some target posterior density $f(\theta| y)$. The computation algorithm build the posterior to catch a unique stationary distribution of the parameters chain. When convergence points are achieved to target density then these draws are used similar to direct Monte Carlo integration[40] to obtain the posterior means and standard deviations. Practically, diagnostic techniques to let the parameter chain to approach convergence to the target density, have been discussed by econometrician researchers such as (Koop *et al.*, 2007; Gelman and Rubin, 1992; Geweke, 2004)[41]. At the beginning of the simulation, there are some draws thrown away (usually it is an initial set of the "pre-convergence" and also called a burn-in phase) and then the convergence is started to match the desired posterior points of the chain (this is called "post-convergence" draws). Different from non-iterative methods, in the post-convergence phase of the iterative methods, it can be seen that there is correlation among draws and the parameter θ^t based on the previous parameter sample in the chain, θ^{t-1}. In a situation where the correlation among the draws is severe, it might be hard to move across the entire parameter region and the standard error will be large. However, if the simulation is having high levels of correlation, then little movement from point to point might happen and it is called "slow mixing "among the parameter chain (Koop *et al.*, 2007).

Chib (1996) stated that MCMC method is quite useful in many statistical applications, it is a simulation procedure which generates a sample of many observations from target distribution. In Markov process, the transition kernel is determined with the property where its limiting invariant distribution is the target distribution. Then computationally, the Markov Chain

[40] According to the same source, (Koop *et al*, 2007) mentioned that the Monte Carlo integration is not easy to calculate directly from posterior draws points, except in some special cases, and the alternative for that using the importance sampling.

[41] In literature, there are many studies have been pointed out to the diagnostics methods. The most famous one is proposed by Koop *et al* (2007) and it is about running multiple chains starting from "overdispersed", and then observe the improvement of parameter chain to determine the points where the chains start to be "settle down" to explore the space similar to the parameter space. However, Gelman and Rubin (1992) include the calculation of the "scale reduction factor" by watching the behaviour across and within chains, focusing on the lag autocorrelations and the associated numerical standard error.

process will be iterated in a large number of points to form the Monte Carlo simulation. After a transient phase and under a particular condition, the output of MCMC simulation will be a sample from the target distribution and will represent the target density by graphical means.

The clue of ordinary Monte Carlo[42]is generally quite easy to understand. Suppose[43] a sequence of random variables $\{X_0, X_1, X_2\ldots\}$ are generated so that at each time $t \geq 0$, the next state point X_{t+1} is sampled from the distribution $P(X_{t+1}|X_t)$ which based only on the current state point of the chain, X_t. (i.e., given X_t, the next state X_{t+1} does not depend further on the history of the chain $\{X_0, X_1,\ldots,X_{t-1}\}$) This sequence is called Markov chain and P(.|.) is named transition kernel of the chain which represents the probability that a process at the state space X_t move to X_{t+1} in a single step. The assumption that the probability distribution of the next future point in the sequence, given the current and the past states point, based only on the current state point is Markov property (Gilks *et al.*, 1996). The distribution of X_t given X_0 indicated by $P^{(t)}(X_t|X_0)$ where X_t based directly on X_0. Subject to regularity conditions, the chain will gradually "forget" its initial state and $P^{(t)}(.|X_0)$ will eventually converge to a unique stationary invariant distribution, represents the target posterior distribution, which does not depend on (t) or X_0. With these results, when (t) increases, the sampled points will look increasingly like dependent sample from stationary distribution Φ (.) according to Baxter and Moore (2002). After observing for long enough sampling, ultimately sets of samples from posterior distribution will be formed after removing some draws of samples at the beginning of markov chain runs, in which it called "burn –in" phase. The "burn- in" term describes the practice of throwing away a number of runs before achieving the stationary distribution. Typically, no grounded theoretical rules of Markov Chain to tell where and how much draws "burn-in" are required to consider as a starting point. All decisions related to a starting point depend on the output runs to have convergence. The output draws are identically but not independently distributed (Raftery, 1996) and will provide Markov chain process to be observed sufficiently, in this respect, every draw will be achieved from the target distribution (Lancaster, 2004).

Two main concerns arising in implementing any MCMC algorithm are: "convergence and mixing". The algorithm yields a Markov chain which converges to an appropriate posterior density and mixes in a proper way throughout the support of the density. In fact, Lynch, (2007) (p.132) pointed out that "convergence and mixing" might be affected by a number of issues; the first issue is "starting values for the parameters", MCMC performance could be affected by

[42] Ordinary Monte Carlo(OMC), is also called "independent and identically distributed (*i.i.d*) Monte Carlo" or " good old-fashioned Monte Carlo", is the special case of MCMC in which X1,X2,….are independent and identically distributed, in which case the Markov Chain is stationary and reversible (Geyer, 2011).

[43] All notations in this section are adaptation from (Gilks *et al*, 1996).

the starting values for the parameters. Put differently, in theoretical framework of MCMC, the MCMC method shows that the algorithm of MCMC will converge on the posterior distribution draws. However, there is no guarantee that it will happen in a finite length space. (e.g. if MCMC algorithm takes 10,000 iterations to achieve convergence, but the algorithm is only run for 1,000 iterations, the algorithm definitely will not have converged and will not have mixed as well). Briefly, if the starting values points were far away from the target distribution points then the draws might be ended before the convergence is achieved. Obviously, the solution for this issue is to find out another and better model (e.g. replace the multivariate Probit models for estimation maximum likelihood to univariate Probit models as starting values for maximum likelihood estimation) or it can be useful to run more iterations, in a limit, to let the algorithm achieves the convergence on the target distribution as another solution. The second issue is "the shape of the posterior distribution", in theory, the posterior distribution has a tendency to be asymptotically normal shape, but in some cases, excluding an important variable such as gender, it causes the multimodality. If the posterior is multimodal, then MCMC algorithm is converged quickly on one mode, but it will not mix well across modes. A simple solution for this issue is to expand the width/variance of the proposal density to make the jump from one mode to another to be easy and possible, or another solution to this issue is to use a better model which includes all relevant variables such as a regression model. The last issue is about the "correlation between parameters". Indeed, the presence of strong correlations between parameters causes slow convergence and mixing, this is because it could be challenging for the algorithm to move from its starting values especially when the proposal densities are broad. Basically, there are three clarifications which make the results more logical and solve the issue such as transformation of the data, or reparametrizing the model, or adjusting the proposal densities. MCMC algorithms produce a sample with high level of autocorrelation, it is clear that the performance of the model with existing a slow mixing problem can affect the variance estimation and it is not correct. Therefore, two approaches have been used to modify the autocorrelation (Lynch, 2007) (p.147). The first approach is called "thinning the chain" and it is about to take every k^{th} sampled value, where k is the number of lags beyond which autocorrelation is not a problem. While the second approach is called "batch means" method, under this method, rather than discarding k-1 out of every k sampled values, one computes the means of every block of k sampled values and treats the batch mean as the sampled value (Lynch, 2007).

Two algorithms "Metropolis Hastings & Gibbs Sampler" are commonly powerful statistical tools to simulate joint posterior distribution, they facilitate good computational procedures for

many complex models. Indeed, Gibbs sampler is considered a special case of the Metropolis Hastings algorithm and this is will be explained in the next sub-section.

4.5.6.2 Gibbs Sampler

Gibbs sampler or Gibbs sampling, is one of the best flexible methods of MCMC algorithm. It is a particular pattern of M-H algorithm introduced by (Geman and Geman, 1984) and extended by (Tanner and Wong, 1987; Gelfand and Smith, 1990). In Gibbs sampler method, the random vector is partitioned into several blocks (subvectors or subsets or subcomponents) and the transition density is defined as the product of the set of full conditional densities (Chib and Greenberg, 1995). The next point in Markov chain is achieved through sampling the full conditional densities in a successive way, given the most recent values of the conditioning parameters. A basic introduction about the algorithm of Gibbs sampler has been provided by (Casella and George, 1992). In fact, sampling repetitively based on full conditional posterior distribution provides the preferred joint posterior density for all the parameters. To avoid draws from multidimensional posterior for all the parameters, Gibbs sampling algorithm suggests the drawing of one parameter at a time, conditional on values of the other parameters (Casella and George, 1992).

To explain the sampling Gibbs method from the posterior $P(\theta|\ Y)$ using three parameters (θ_1, θ_2, θ_3). Denote (y) is the collection of available data, the objective here is to estimate the parameters in order that the fitted model can be used to make inference. Assuming that the likelihood function of the model is difficult to calculate, while three conditional distributions of every single parameter give the others are available as following: $p_1(\theta_1|\ \theta_2, \theta_3, y)$, $p_2(\theta_2|\ \theta_3, \theta_1, y)$ and $p_3(\theta_3|\ \theta_1, \theta_2, y)$. In application, it is not necessary to know the precise forms of the conditional distributions, the important thing is to draw a random sample from each of three conditional distributions.

Gibbs sampler iterative process is:

0. Assign a vector of arbitrary starting values, S, to the parameter vector: $\theta^{j=0} = S$.
   [Example: (θ1, 0, θ2, 0, θ3, 0) are arbitrary starting values respectively].
1. Set up j=j+1 where j indexes the iteration count.
2. Draw a random sample from p1 $(\theta_1^j|\theta_2^{j-1}, \theta_3^{j-1} \dots \theta_\kappa^{j-1}, y)$.
3. Draw a random sample from p2 $(\theta_2^j|\theta_3^{j-1}, \theta_1^{j-1} \dots \theta_\kappa^{j-1}, y)$.
4. Draw a random sample from p3 $(\theta_3^j|\theta_1^j, \theta_2^{j-1} \dots \theta_\kappa^{j-1}, y)$.

Then ….

k. Sample p $(\theta_k^j \big| \theta_1^j, \theta_2^j, \ldots., \theta_{k-1}^j)$.

k+1 Return to step 1.

At this point Gibbs iteration is completed. Then another new parameter will be used as starting values, one more Gibbs iteration is then completed. For (n) times, Gibbs process will be repeated and then a sequence of random draws for all parameters $\{\theta_{1,j}, \theta_{2,j}, \theta_{3,j}, \ldots \theta_k\}_{j=1}^n$ is achieved. Lynch, (2007) pointed out that Gibbs iteration includes a sequence of parameters sampling from the conditional distribution for every parameter given the present value of all the other parameters and frequently cycling through this updating process. Every "loop" happening through the process is known as "iteration" and with every new starting value of a parameter, it will be obtained a new "updating" value. Under some regularity conditions, it can be seen that, for using a sufficiently large sample, the previous sequence is approximately equivalent to a random draw from the joint distribution of the parameters, $P(\theta_1, \theta_2, \theta_3|y)$ (Tsay, 2010). If these conditions are weak; then the regularity conditions necessary require arbitrary starting values ($\theta_{1,0}, \theta_{2,0}, \theta_{3,0}$). In this respect, the prior Gibbs draws have a chance to visit the full parameter space (Tsay, 2010). Under Markov chain property, the Gibbs sampler convergence will be obtained when the simulated sequence is Markov chain with a unique stationary distribution. In other words, the stationary distribution draws are the same of the target distribution draws (Tierney, 1994).

Breaking a high- dimensional parameters space into several lower dimensional ones by using full conditional distributions of the parameters can be considered an advantage of Gibbs sampling method. In precise words, the power of Gibbs sampler when applied to (N) univariate full conditional distributions may possibly be a solution to a high – dimensional issue with (N) parameters[44]. However, in some cases, Gibbs Sampler may not be the most efficient MCMC algorithm particularly if the parameter coordinates are highly correlated in the posterior distribution. Once the correlation is very high between the parameters, then Gibbs draws will be jointly (Tsay, 2010) and the correlation will cause very slow mixing of the sample (Mira, 2005). From a computational point of view, Mira, (2005) (p: 424) has supported that the full conditional distributions are not easy to obtain and sample in an i.i.d fashion; the full conditionals distributions force the sampler to make a move parallel to the main axis of the space and the legal moves might have very limited range due to high correlation . In Gibbs

[44] Spiegelhalter, *et al*, (1995) demonstrated this point via software WinBUGS (Bayesian Inference Using Gibbs Sampling)

sampler application, Lynch, (2007) revealed that it is sufficient for the full conditional density distributions to be known only up to a normalizing constant, this in its turn can suggest that using the joint density reduces the known forms for each parameter while all other parameters are treated as fixed.

In spite of the worthiness of Gibbs sampler to achieve good simulation results, the method still has some issues (Chib, 1996). In fact, performance of Gibbs sampler method often based on the problem at hand, the first issue in implementing Gibbs sampling is designing the blocks, for the components which are extremely correlated, it is useful to cluster them together into groups. Otherwise, the property of Markov Chain starts displaying autocorrelations to slow down the convergence to the target density and this in its turn will be affect the results of the simulation (Liu *et al.*, 1994). The second issue is getting a controlled full conditional densities structure in simulation. To obtain that, it is useful to add variables or missing data to the sampler, known as "data augmentation". The last issue is about the difficulty to sample some conditional densities by traditional means such as by the method of rejection sampling, it is quite convenient to cope with the density by applying M-H algorithm (Müller, 1991) or deal with a method which create independent samples (Gilks and Wild, 1992).

4.5.6.3 Metropolis-Hastings algorithms

Metropolis – Hastings algorithm (M-H Algorithm) is a very general recipe to build Markov chain samples with regard to a specified complex probability distribution $p(\theta)$ and using the full joint density function. M-H algorithm was introduced by (Metropolis *et al.*, 1953; Hastings, 1970), they generalized the Metropolis algorithm by utilizing a random transition probability function and setting the acceptance probability for a candidate point. Actually, when the form of the conditional density is unknown then M-H algorithm is mainly used over other methods of sampling. The transition probability is a conditional distribution function that represents the probability of moving from the current point to a future point for the same parameter.

M-H algorithm is considered applicable in some cases such as working with multivariate distribution (Lynch, 2007) or where the conditional posterior distribution is known excluding a normalization constant (Metropolis and Ulam, 1949; Metropolis *et al.*, 1953). Suppose that the H-M algorithm (Metropolis and Ulam, 1949; Metropolis *et al.*, 1953) can generate an order of draws from the distribution $P(\theta)$, where $P(\theta) = f(\theta)/K$, K denotes the normalizing constant and it is not known or might be difficult to compute. All notations in this section are adaptation from (Walsh, 2004) as following:

1- Establish the initial value θ_0 where satisfying $f(\theta_0) > 0$. Like in Gibbs sampler algorithm, the essential step in the M-H algorithm is to establish the initial starting value, it could be obtained through maximum likelihood estimation or any other arbitrary sampling methods (Lynch, 2007). However, Tierney (1996) pointed out that regardless how the starting value is chosen, the algorithm's stationary distribution should be the posterior distribution in terms of MCMC theory.

2- Using the current θ value, sample a candidate point θ* from some proposal density distribution $q(\theta_1, \theta_2)$[45], which is the probability of returning a value of θ_2 given a previous value θ_1. The only restriction on the jump density in the Metropolis- Hastings algorithm is that it is symmetric, {i.e. $q(\theta_1, \theta_2) = q(\theta_2, \theta_1)$}. When the proposal density is symmetric, then the acceptance probability reduces to $\frac{f(\theta^*)}{f(\theta_{t-1})'}$ which is considered the original form of (Metropolis *et al.,* 1953).

Lynch, (2007) mentioned that the candidate value for the parameter θ* is obtained by simulating a value for it from proposal density $q(\theta_1, \theta_2)$, and the simulated value can be considered a "candidate" because it is not automatically accepted as a draw from the distribution of interest; it must be evaluated for acceptance just as in rejection sampling. In the context of M-H algorithm, Lynch, (2007) distinguish between two general approaches to choose the proposal densities distributions; "Symmetric & Asymmetric". Using symmetric proposal density distribution centred over the previous value of the parameter such as normal or uniform distribution46, will produce "random walk Metropolis algorithm" (Gelman *et al.,* 1996; Walsh, 2004) and the result implies that the chain is just as likely to move from the candidate to the previous value as it is move from the previous value to candidate. While using the asymmetric proposal density distribution means $q(\theta_1, \theta_2) \neq q(\theta_2, \theta_1)$; in other words, there is greater probability that either the candidate would be proposed when the chain is in state θ_1 than θ_1 would be proposed when the chain is in state θ_2.or vice versa[47]. Under this kind of asymmetric proposal density, the chain will be "an independent chain" and the probability of jumping to a new point is independent of the current point position (Walsh, 2004).

3- Given the candidate point θ* , calculate the ratio of the density at the candidate (θ*) and previous (θ_{t-1}) points, so that θ* therefore generated is accepted with probability $\alpha(\theta_{t-1}, \theta^*)$, to define the algorithm as following:

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[45] The distribution $q(\theta_1, \theta_2)$ is also called the jumping or candidate- generating distribution. Gelman *et al.* (2014).

[46] As it occurs with a normal or multivariate normal with mean zero, or a uniform centered around zero (Walsh, 2004)

[47] There are three cases to use asymmetric proposal density distribution (for more details see, Lynch, 2007, p: 100-112).

$$\alpha(\theta_{t-1}, \theta^*)=\begin{cases} \min\left(\frac{f(\theta^*|y)\, q\,(\theta^*|\theta_{t-1})}{f\,(\theta_{t-1}|y) q(\theta_{t-1}|\theta^*)}, 1\right), if\ f(\theta_{t-1}\,|y) q(\theta_{t-1}\,|\theta^*) > 0 \\ 1, \qquad otherwise. \end{cases} \quad (4.34)$$

As it can be seen from the previous formula, if the asymmetric proposals density are used, then the correction factor in the ratio α (θ_{t-1}, θ*) will help to adjust for the asymmetry. Lynch, (2007) explained the two parts of the ratio; the first part of the ration is {f (θ*|y)/ f (θ_{t-1}|y)} called the "importance ratio" and it represents the ratio of un-normalized posterior density evaluated at the candidate parameter (θ*) to the posterior density evaluated at the previous parameter value (θ_{t-1}). The second part of the ratio is {q (θ*| θ_{t-1})/ q (θ_{t-1}|θ*)} and it is the ratio of the proposal densities evaluated at the candidate and the previous points.

4- If the candidate point is rejected, then the next draw value is chosen to be the current value.

If the jump increases the density (i.e. α (θ_{t-1}, θ*) > 1), accept the candidate draw (set θ_t = θ*) and return to step 2.

If the jump decreases the density (i.e. α (θ_{t-1}, θ*) < 1), then with the probability α (θ_{t-1}, θ*) accept the candidate point, else reject it and return to step 2.

Therefore, the acceptance probability states that chain will move with probability 1 in a direction of higher posterior probability if offered by the candidate-generating density, or otherwise it will move with probability α (θ_{t-1}, θ*) to the new point. This implies that if α (θ_{t-1}, θ*) is compared with a U (0, 1) random draws, and α (θ_{t-1}, θ*) > U (0, 1), then θ_t = θ*, otherwise $\theta_t = \theta_{(t-1)}$.

Johnson and Albert, (2006) pointed out an alternative way to compare the ratio with the draw of u (0, 1), they presented "accept the candidate with probability min (ratio, 1)" where "min" function is included as a formality to indicate that probabilities cannot exceed 1.

5- Repeat steps 2, 3 and 4 T times.

6- Take the average of the T draws.

Koop (2003) discuss why the M-H algorithm does not accept every candidate draw, the reason of that is because the candidate – generating density distribution is not akin to the posterior distribution points; therefore, if left to wander freely, it will not take the right number of draws in each area of the parameter space. It drives an acceptance probability which is highest in areas where posterior probability is highest and vice versa (Koop, 2003). Accordingly, if $\theta_{(t-1)}$ represents a specific region of low posterior probability then the algorithm will move quickly

form this point. While, if $\theta_{(t-1)}$ represents an area of high posterior probability then the algorithm will stay at the same place (Koop, 2003).

Despite the Markov Chain theory has been suggested that a chain should ultimately converge to a stationary distribution. However, applying M-H algorithm, it should give more attention when the candidate –generating density is chosen, otherwise, most of the candidate draws will be rejected and the chain will be trapped at a certain point for long time. Thus, MCMC convergence diagnostics should be under consideration at this point (Koop, 2003).

4.5.6.4 Convergence Diagnostics

Convergence diagnostics is a formal calculation tool for determining analytically the length of burn-in period (*m* draws) to achieve the convergence stationary distribution points of the chain, which is also representing the target distribution. However, no guarantee that the chain will converge after *m* draws. Geyer, (1992) suggested that it is not necessary to calculate the length of burn-in period to start the convergence and mixing draws around the parameter space; it is probably can be between 1% and 2 % of the total length of the chain when the starting draw values are extremely avoided. A variety of theoretical methods and approximations (both visual and statistical) have been proposed to determine the convergence values based purely on MCMC outputs. Statistically, the results give the posterior means, posterior standard deviations, and posterior quartiles for each variable. Obviously, "visual inspection of plots of MCMC output" is the most common method which has been used by (Gilks *et al.*, 1996) to determine the convergence of posterior estimation points. The chain is mixing and moving around the parameter space to converge and do inspections for every parameter. Sometimes the chain gets stuck in a certain region so this reflects in bad mixing draws. In addition, (Geweke, 1991; Gelman and Rubin, 1992; Raftery and Lewis, 1992) used the methods that rely on convergence monitoring, which partitions a sample into two parts after eliminating the burn-in period. If the chain is under stationary situation then the means of two samples have a duty to be equal. A modified *t*-test is used to compare if the first and second halves of the values draw from the chain have the same mean.

Koop, (2003), mentioned that achieving the model convergence by using the standard diagnostics is monitored into three ways; visually by using the traceplots (the plot of the values against the value of the draw of the parameter at each iteration) or traceplots and density plots or running mean plots. The second way of assessing the convergence is the estimation of autocorrelations coefficients between all the draws in MC to examine the degree of dependence of the sampled values. The third way is the modified *t*-tests as mentioned earlier.

Convergence diagnostics classifications depend on whether be grounded by using an arbitrary function *f(x)* of Monte Carlo results or not; whether using the output from a single chain or from multiple chains, and whether based purely on Monte Carlo output (Gilks *et al.*, 1996).

Chapter Five: Data Collection & Qualitative Findings

5.1 Introduction

This chapter describes the data collection exercise undertaken for the discrete choice experiment designed to elicit the preferences and willingness-To-Pay (WTP) of UK consumers for Syrian organic olive oil. Qualitative findings have included in this chapter for FGD & VPA.

5.2 Description of the Study Area

This study has been chosen in order to examine the olive oil market in the UK. The UK is considered a non-producer country of olive oil and its market for olive oil is an emerging and non-tradition market compared with the Mediterranean market. Despite the annual income spent on food in the UK, the use of olive oil is a small percentage around 8.9 % in England and 7.5% in Ireland compared with other countries around the world (Washington State Magazine, 2008), but there are increasing trends by the consumers toward health and safe food.

Within the oils and fats market, sales of oils and fats by different categories (e.g. Butter, margarine, olive oil, vegetable and seed oil, …etc) have increased from 616.4 thousand tonnes in 2010 to 619.1 thousand tonnes in 2015. More specifically, for olive oil sales, it has increased from 28.6 thousand tonnes in 2010 to 31.5 thousand tonnes in 2015 (Euromonitor, 2015). However, the sales for olive oil in the UK market was £150.3 million in 2010 rising to reach £168.7 million in 2015 (Euromonitor, 2015). It can be seen that there has been substantial growth in the UK olive oil market over the last few years. The consumption patterns of olive oil have changed and were initially driven by British consumers concerns and awareness of health issues and nutrition in food, quality of olive oil and good quality taste and their willingness to reduce fat consumption in their meals and cooking.

Recently, it has been seen that a greater variety of olive oil products and vegetable oils are available in the domestic market in the UK. This gives an opportunity for a new product, such as Syrian olive oil with its comparative advantage, to exist in a new emerging market like the UK olive oil market. Currently, the olive oil supply in the UK market is covered entirely by imports from Mediterranean countries like Italy, Spain, and Greek. These imports nearly doubled in the UK in the last few years (Kavallari *et al.*, 2011) and the Italian and Spanish olive oil are the dominant products in the UK (e.g. 40% of the total olive oil imports from each country between 1995-2006). However, the imports form non-EU Mediterranean countries are 0.2% of the total olive oil imports in the period of time 1995-2006 (Kavallari *et al.*, 2011).

5.3 Determining the Target Population

The sample selection for the choice experiment was aimed at generating a representative sample of UK consumers relevant for the study. The appropriate target population in market studies may be related to a specific product (Damgaard *et al*., 2011) and may depend on who is or will be paying for the product and the type of value that is being measured (Fujiwara and Campbell, 2011). The selection of respondents requires inclusion criteria (i.e. a set of conditions that must be met for respondents in the case study) and exclusion criteria (i.e. the condition would not allow the respondents to participate in the study) for the respondents of the study (Wingood and DiClemente,1998). Burns and Grove, (1997) define the target population as the entire aggregation of respondents that meet the designated set of criteria.

As this study was carried out in the context of the UK market, two criteria were used to select respondents to complete the survey online; the first criterion was that the respondents should be British nationals because one objective of this study is to investigate what exactly the British consumer preferences toward organic olive oils are. They should not simply be British residents because British residents might be from different countries and have British nationality and they also might have an experience of consuming olive oil especially if the respondents is from Mediterranean Basin. The second criterion was that the respondents should be consumers who consume olive oil, the second criterion would help to meet the outlooks of the UK potential market for Syrian organic olive oil.

5.4 Sampling Procedure & Sample Size & Recruitment the Participants & Time Scale

Sampling procedure refers to methods adopted for ensuring that the selected sample is representative of the target population. Many sampling procedures have been developed to make certain that the sample effectively represents the target population. The most common one is simple random sampling in which every individual in the target population has the same equal chance of being part. The random sampling method requires two elements for implementation; first to have a complete list (sampling frame) of all participants of the population of interest and second to ensure that the selection is made randomly from the list.

Sample Size: The size of the sample needs to be compatible with the research objectives, the use of the data, and the statistical robustness required. In stated discrete choice experiment, it is difficult to determine the size of the sample. The number of individuals (N) for the stated preference concepts in the discrete choice experiment is difficult to answer. Some researchers have used rules of thumb based on their experiences to assess the size of used sample in the study. Orme (1998) produces an equation to calculate the population sample used in stated preferences experiment as:

$$N = 500\frac{\ell^*}{J.S} \quad (5.1)$$

Where: N: is the size of the sample. ℓ^*: is the largest number of levels for any of the attributes. J: is the number of alternatives (options in the design). S: is the number of choice situations in the design. For this research, the sample of the survey represents the national level of the British consumers in the UK. Based on the formula (5.1) the sample size should be around 260 participants while the size of sample used in this study is 412 participants.

Recruitment of the Participants: A paid list of people via a marketing research company is used to recruit individuals for participation in terms of the research objectives "consumer behaviour toward consuming olive oil product". The participants for focus group discussion and verbal protocol analysis were recruited by "Sensory Dimensions Ltd". Sensory dimension is a market research company focused on consumer sensory testing and research about food and different products in the market, qualitative and quantitative consume research. It operates internationally and in the United Kingdom. The participants are selected in terms of having British nationality and buying olive oil product. FG has eight participants for the discussion while VPA has nine participants. However, the respondents for survey which was administrated online were recruited by "Qualtrics Survey Software". Qualtrics is a market research software company which focuses on consumer research and customer satisfaction and loyalty. Respondents were selected based on having British nationality and buyers' olive oil. The company had large databases of respondents in diverse locations and representative of the UK population then it took the responsibility of sending emails to all respondents that probably were able to complete the survey. A total of 412 respondents completed the survey.

Time scale: The larger the sample, the longer the time of collecting data is generally taken to undertake. Qualitative methods took three months (August 2013 to November 2013) to collect FGD and VPA data. Later, it took two weeks to transcript all the recorders and write reports about the most important attributes of olive oil product to present them in a choice experiment application. After that, a paper copy of survey was prepared and the pre-testing stag took around seven months (from January 2014 to July 2014). Then, from August 2014 to March 2015, the survey was designed in Qualtrics survey software. The survey was administrated in 2014 with quotas set to approximate population statistics for the Qualtrics company respondents in terms of British nationality and consuming olive oil product.

5.5 Online Survey Design

After the pre-testing stage, a final version of the online survey instrument was developed. A covering letter with a description of the study purpose and explanation of attributes of olive oil product was attached to the survey (section II). Qualtrics Market Research Company was hired to recruit individuals older than 18 years who were British nationality and were buyers or consumers of olive oil products. Qualtrics Company offered incentives to participants who completed the questionnaires. Four versions of the questionnaire design (called Block A, Block B, Block C, and Block D) were randomly allocated to the participants. Each questionnaire consisted of six sections All the versions of the questionnaire had identical questions except for the choice cards: [48]

5.5.1 The First Section (I)

This section included three screening questions to check the gender of the respondent, whether the respondent was a British nationality and was a buyer or consumer of olive oil. This section also provided background information about organic olive oil attributes and their levels to help the participants to understand the choice task later on in the survey.

5.5.2 The Second Section (II)

This section included an example of a typical choice card. Each choice card consisted of three options (Option1, Option 2, and Option 3). Each option was a combination set of the attributes of olive oil product. The level of each attribute could change from one option to another. After reading carefully all of the options on choice card, the participant was asked to indicate the preferred option by ticking one at the boxes next to the "I would like to choose" option. The participants could also tick the "I do not know "option**.**

Table 5.1: An Example of Choice Card.

Question to the participant: Please tick the box which represents your preferred option:

Attribute	**Option 1**	**Option 2**	**Option 3**	
Organic	Non-Organic	Organic	Non-Organic	
Country of Origin	Italian	Spanish	Syrian	
Colour	Green	Dark Green	Yellow	
Packaging	Glass	Plastic	Glass	
Flavour	Fruity	Nutty	Bitter	
Type (Grades)	Extra-Virgin	Standard	Extra-Virgin	
Taste	Smooth	Strong	Smooth	
Fairtrade	Non-Fairtrade	Fairtrade	Fairtrade	
Price	£3.16	£5.30	£4.99	
	Option 1	Option 2	Option 3	I do not know

[48] Appendix 4, Includes the design of questionnaire in details.

I would like to choose	☐	☐	☐	☐

5.5.3 The Third Section (III)

Thirteen choice cards were presented in the third part of the questionnaire. Information and instruction were given. In choice modelling respondents choose between options making trade-offs between attributes and their levels. One of the attributes included is a monetary payment (price of the product). The trade-offs made, in turn, helped to estimate the monetary value for each attribute. Choice modelling derives the value for each attribute using the marginal prices of the change of the attribute.

5.5.4 The Fourth Section (IV)

This section included a follow-up question that was used to investigate Attribute Non-Attendance. The participant was asked to indicate whether they paid attention to, or ignored, each of the attributes while making their choices. Choice modelling tasks are cognitively complex and demanding and consequently some respondents may rely on simplified heuristic decision rules using only certain attributes and ignoring others in making their choices.

5.5.5 The Fifth Section (V)

This section included a series of follow-up questions in which respondents were asked to rank the importance of different attributes on a scale from highest to lowest importance. Questions were also included to assess whether the respondents understood the attributes of olive oil products referred to on the choice cards. Other questions were intended to assess whether the respondents were using price as a cue for quality, the main purpose for which they used olive oil products and their preference for Syrian organic olive oil over all other types of olive oils.

5.5.6 The Sixth Section (VI)

This section elicited information on the socio-demographic characteristics of the respondents and contained questions on gender, age, education and income and size of household. This information was used to establish the representativeness of the sample with the population of interest and to help in modelling the choice experiment. It was also used to observe heterogeneity into four categories (age, gender, size of household and income) and covered the relationship between the socio-demographic characteristics and the utility estimation and WTP estimation.

In the survey, overview information of the attributes and the levels of the attributes was provided to the respondents before eliciting actual preferences form the choice sets. Each choice card consisted of options with a combination of the attributes and the levels of the attribute.

A D-optimal design was used generating in total 48 choice card sets. Supplementary choice sets were used to assess whether respondents were using price as an indicator of quality of olive oil products. The survey was split into four blocks where each block included (12) choice cards plus one choice card related to the use of price as a cue for quality. Therefore, every respondent evaluated 12 + 1 = 13 choice card sets.

The total of 414 respondents completed to questionnaire. One response was excluded because the respondent answer "I don't know" for all questions in the survey, and another was also excluded on account of having attempting two choice cards in the online survey. As a result, the total number of respondents who correctly completed the questionnaire was 412.

5.6 Advantages & Some Limitations of Conducting Survey Online:

The design of a discrete choice modelling survey online is a good exercise having many issues at the same time. Online surveys for choice modelling have certain advantages:

1. Online questionnaires can be designed to constrain the respondents to answer questions in a sequential or logical order (with appropriate skips provided) with built in checks for consistency and accuracy.

2. The survey can be conducted fairly rapidly saving considerable time for the researcher (in relation to the time it would take conduct face-to-face paper surveys).

3. Online surveys involve considerable cost savings in relation to conventional paper based face-to-face surveys.

4. Online surveys are convenient for respondents. They can start at any time and complete it later on.

5. Collating and aggregating data from online questionnaires (e.g., in spreadsheets) is easy (avoids burden of manual data entry) and this facilitates quicker analysis of the data.

However, administering the survey instrument online has certain disadvantages:

1. It may be difficult to recruit a sample representative of the population online.
2. Recruitment of respondents is limited to those with internet access and familiarity with internet use which may exclude certain demographic segments.
3. Where respondents lack background information, supplementary information cannot be provided on demand as could be done in face to face surveys.

5.7 The Strengths and Weaknesses of Choice Experiment

The most common advantages of choice experiment are summarized as:

1. CE allows measurement of the marginal utility value of changes in attributes. This is useful for the design and introduction of new products in the market.
2. CE, based on orthogonal experimental designs, avoids the problem of multi-collinearity found in RP studies (in RP studies certain attributes may always move together and cannot be varied independently of one another).
3. CE allows the valuation of individual attributes and an understanding of how consumers make trade-offs between attributes and their levels.
4. CE, by including the status quo option, provides valuation (WTP) for several product alternatives within the framework of the same experiment.

While the previous points mentioned are the advantages of CE, there are disadvantages as well in the design of experiment,

1. In CE design, there are some factors can influence the value of marginal utility estimations such as the attributes choice, levels of attributes presented to respondents.
2. In the application of stated CE, respondents are assumed to answer a number of tasks. The complexity of these tasks as well as cognitive burden may make the respondents try to simplify their decisions by using heuristics rules, this is in its turn will affect the results of CE.
3. Some technical issues can face the analyst in interpretation the results of CE such as the violation of IIA.

5.8 Qualitative Findings

The third research question of this study requires an investigation of the preferences of British consumers towards olive oil products in general and particularly for Syrian organic olive oil. Therefore, as explained previously, application of stated preference techniques (choice experiments) requires the identification of the most important attributes of olive oil and their levels. Focus Group Discussion (FGD) and verbal protocol analysis (VPA) were employed to identify key attributes of olive oil products from the perspective of consumers. This chapter describes the planning and organization of the FGDs. The application of VPA to analyse the information obtained from the FGD and the key insights regarding the attributes of olive oil products from a consumer perspective.

5.9 The Planning and Organization of the Focus Group Discussion

The FGD was held on 25th of October 2013 at 11 am in Casey Harold Room, School of Agriculture, Policy and Development, University of Reading. The room environment was

comfortable for the participants to share their thoughts, preferences, and beliefs about olive oil products. The discussion was provided with some samples of olive oil with different brand names, country of origin labels, different bottle shapes, and different colours. The discussion was videotaped and recorded. The FGD had eight participants and it lasted between 1-2 hours (See Appendix 2); the group were recruited by a private market research company is called "Sensory Dimension Ltd" company. Three of the participants were organic olive oil consumers and the rest of the group were non- organic olive oil consumers. The discussion has provided my research with the valuable insights into how consumers view olive oil products and their attributes. The participants group had the following socio-demographic characteristics.

All the participants were females. Of the participants 4 (50%) were aged between 35-44 years, 2 (25%) were aged 25-34 years, one participant was aged 45-54 years, and one participant were aged 55-65 years. All the participants were married except one, who was single and another was widowed. (62.5%) of the participants had two children, 2 (25%) had three children, and one participant had no child. In terms of the level of education, 2 (25%) had postgraduate degree, 2 (25%) had Secondary school level education, 4 (50 %) prefer not to answer on this question. 37.5% of FG participants had entire salary or pension as a main source of income while 62.5% prefer not to answer on this question. According to the monthly range of income: 12.5% had more than £3000, 12.5% of them have £2000-£3000 and the 12.5% between £1000-£2000 and 62.5% no answer for this question.

To provide a good understanding form the data that was collected from the focus group's participants, the following section includes the initial part of our findings including some knowledge and information about the main reasons of using olive oil products and then the participants cited the main attributes of olive oil product that they put them into consideration during the buying process.

5.10 Analysis Technique of Focus Group Discussion

Although there is a long history of the use of FGDs in qualitative analysis, there are no preferred methods of analysis of FGD data (Morgan, 1997). Leech and Onwuegbuzie (2007 & 2008) provide a good overview of several qualitative analysis techniques that can help researchers to interpret data in different ways. They propose different methods of analyzing FGDs such as classical content analysis, constant comparison analysis, keywords-in-context and also discourse analysis.

Briefly, *constant comparison analysis* involves three main stages (Corbin and Strauss, 2014), the first stage is "open coding", the researcher will chunk the data into small unites and then

match the codes with every unit. The second stage is "axial coding" where the codes are clustered into categories, and the last stage is "selective coding"; in this part, the researcher will develop one or more themes that demonstrate the content of each of the groups (Corbin and Strauss, 2014). This method is useful in a case of having multiple FG(s). *Classical content analysis* is a little different from the constant comparison analysis. It includes creating small chunks of the data set and state a code for each chunk. Then the researcher will count these codes. Third method is *discourse analysis*, Jørgensen and Phillips (2002) pointed out that discourse analysis form includes unique segments or components of language use (such as few lines of a FG transcript) and then the researcher starts analysing them in details to explore how versions of elements for instance the society, community, experience … etc occur in discourse.

Finally, *keywords-in-context method*, which is used for the purpose of this study, is about determining how words are used in the discussion context by comparing with other words. Fielding *et al.*, (2008) noted that this method represents an analysis of the culture of the use of words. The main assumption of this methods that the participants in the discussion use the same words or same phrases differently many times; hence it is necessary to test how many words have been used in the transcription of discussion. Therefore, Onwuegbuzie *et al.*, (2009) mentioned that every word is used by FG participants in the discussion should be interpreted with respect to other words used by all FG members. For example, 60% of the participants stated in the FG discussion that they prefer Italian olive oil to any other in respect of country of origin. Analysis of the FGD transcripts using the keywords-in-context technique shows that this preference was conveyed in a number of different ways, e.g., by reference to the terms "Italian" …"Mediterranean from Italy" …"Filippo Berio" …"Napolina brand name" and so on, all these usages convey that the participants prefer the Italian olive oil and they can coded under one category (country of origin) while the percentage (60%) means that five participants out of eight the uttered those previous keywords. And this method is applied for the rest of FG transcript written copy.

5.11 The Main Discussion of Focus Group

The first stage of the focus group discussion concentrated on identifying the main uses of olive oil products in order to steer the discussion to relevant attributes of olive oil and their levels. The FGD was based on a set of questions prepared in advance before conducting the FG discussion (See Appendix 2). At the beginning, some of these questions included the open-ended questions aimed at encouraging participants to contribute to discussion. These questions were designed to allow the participants to express their opinions freely. The discussion was started by inviting participants to express and share their thoughts, preferences and ideas about

olive oil products. Following this, participants were asked to specify the most important characteristics of olive oil they considered while making purchase decisions and narrow down the set of attributes. The participants were provided with some samples and brand names of different olive oil products and pictures to elicit some specific words about the product in the context of purchasing olive oil. For some specific attributes, which were not referred to by participants, prompts were provided to encourage them to talk about them. The main summary of FG findings is organized as following:

Table 5.2: Main Findings from FG Discussion

In terms of Consumption Behaviour	Health benefits. Cooking & daily life uses.
In terms of Purchasing Behaviour	Price of Olive Oil Country of Origin Grade of Olive Oil Taste of Olive Oil Flavour of Olive Oil Organic or not Colour of Olive Oil Shape of the bottle and its capacity Brand Name. . Packaging material
In terms of Olive Oil Knowledge	British participants don't have that much of information about olive oil grades.

Source: Focus Group Discussion 2013.

5.12 Findings and Knowledge from Focus Group Discussion

The most important findings from FG discussion have been included in this section and there are some quotes mentioned by the participants in Bold/Italic format. Our interesting findings as following:

5.12.1 Usage of Olive Oil Product

The vast majority of the participants had generally more positive thoughts and opinions of olive oil products and were more predisposed toward buying olive oil than before. The main usage of olive oil was found in the kitchen where its uses appear to be numerous. The participants preferred using olive oil products for daily meals, cooking application and brushing on food. To some extent, they used olive oil for dressing salads, dipping with bread, and drizzling over

pasta dishes. A participant (P_{FG}. No 2)[49] said: ***"I prefer to use olive oil for cooking and roast potatoes and salad dressing"*** while other participants pointed out that the less common use of olive oil is for baking or shallow frying because high heat will burn olive oil over its smoking point. At the smoking point, the oil starts to break down its ingredients and gives an unpleasant taste, participant (P_{FG}. No 5) stated: ***"I don't like to cook with it because it has a high degree burn"***. While another participant (P_{FG}. No 7) stated that olive oil was tasty for frying eggs ***"I found that fried eggs in olive oil were delicious, so I bought extra virgin olive oil because I thought it would be better than the vegetable oil I had used before".***

Originally, olive oil has a long history with medicinal connotations, it was used for some purposes before being a common ingredient in the kitchen, such as drops in the ears or as a baby lotion. Participant (P_{FG}. No 8) said: ***"you can find it in the pharmacy in a small bottle. A few drops put in the ear, could be useful if you have problem with ear wax"*** and some participants mentioned that olive oil is beneficial for solving a constipation problem, participant (P_{FG}. No 1) said ***"it is supposed to have amazing results especially for the people who are suffering from a constipation issue"***. Also, for a dry cough issue, mixing olive oil and some raspberry vinegar, might be useful especially for children, participant (P_{FG}. No 3) stated: ***"My friend had suggested olive oil mixed with raspberry vinegar would help my child's cough, I tried this and saw an improvement after a while".***

Finally, olive oil is moving from the medicine cupboard to be found in the bathroom among shampoos and other beauty products, it is also used in beauty routines as a conditioner for hair or nails or body.

5.12.2 Organic or Non- Organic Olive Oil

The majority of focus group participants had prior experience of the use of organic products and knowledge about the safety and health aspects of these products such as organic olive oil. Participant (P_{FG}. No 8) said: ***"The meaning of organic is that there is no pesticide in it".*** It was noticed from the discussion that the participants were focused on the perceived health benefits from olive oil product and this in its turn was very important for the consumption behaviour, while the price attribute was the most important for the purchase of high quality olive oil products. Another participant (P_{FG}. No 4) stated: ***"If my husband did the shopping he would probably get the most expensive organic product, but if I am doing the shopping I would go for the cheaper one".*** Another participant stated that organic olive oil is a high-quality product but would not necessarily buy it on price considerations, participant (P_{FG}. No 6) said

[49] (P_{FG}. No) is the code which used in Focus Group data, (P) is for Participant. (No) is the Number of participant. (FG) is Focus Group.

"I really expect organic to be a better quality product, but that would not necessarily make me buy it because I also take the price into consideration. If I would like to use a more pure taste of olive oil for salad dressings, I might be more thoughtful about that, but I am not a huge fan of the pure taste of olive oil.".

5.12.3 Type (Grades) of Olive Oil Product

In the discussion, fifteen samples were shown to investigate preferences for different types of olive oil products. These samples included extra virgin, virgin, pure olive oil, light oil for frying. For the types of oil for which we did not have physical samples, pictures were shown to participants.

Most of the participants in the discussion stated that they did not know the difference between different grades of olive oil. They were familiar with only one or two types of olive oil in stores and often picked extra virgin olive oil without knowing why they were selecting it. Participant (P_{FG}. No 5) said: ***"I don't know much about that".*** Some of them pointed out that extra virgin means oils extracted from the first pressing of olive fruits. Participant (P_{FG}. No 1) said ***"it is from the first pressing or cold pressing".*** It seems that the participants did not have enough information that grades of olive oils are related to the degree of acidity. At the same time, some participants talked about using different grades of olive oil for different purposes, participant (P_{FG}. No 7) said: ***"I use extra virgin (high quality) for salad but for cooking I used the light one".***

The participants did show some awareness of different grades of olive oil although they were not entirely sure which were appropriate for different purposes such as cooking, salad dressings… etc. Older participants of FG had more experience of consuming olive oil. They stated that although the product had always been available in the market people had started using a lot of olive oil in the last few years. Figure 5.1 shows that four participants prefer extra virgin olive oil and three participants pointed out that they might use pure olive oil, while one person mentioned that she used light olive oil.

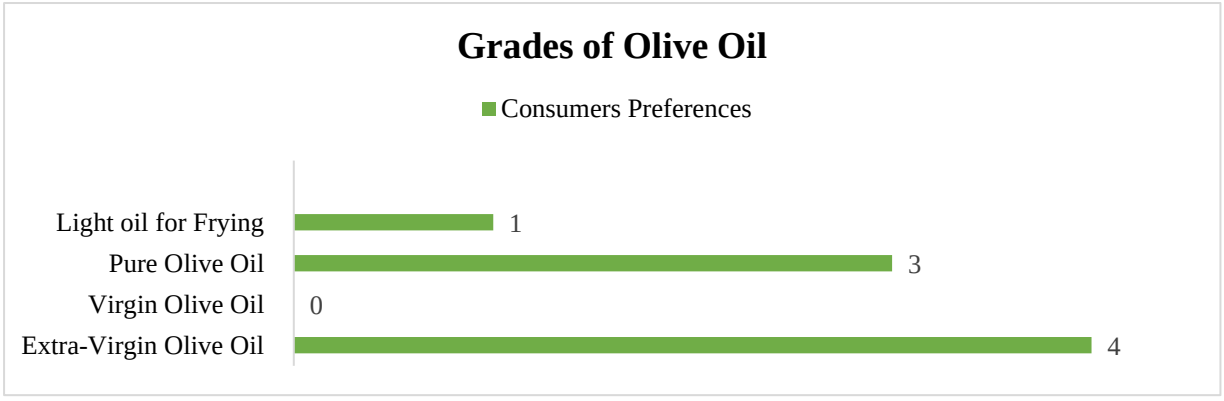

Figure 5.1: Consumer Preference for Olive Oil Grades

Source: Focus Group Discussion, 2013.

5.12.4 Brand Name of Olive Oil

The participants were familiar with the specific brands of olive oil which they associated with the country of origin. Italian olive oil was the most well-known to all participants and the most used brands were "Filippo Berio" or "Napolina". The participants mentioned that they usually bought Italian olive oil due to its reputation and the high quality associated with its Mediterranean origin. However, when it was mentioned that the country of origin source is mentioned on the label of every bottle of olive oil, they expressed their preference for olive oil from the nearest countries, not distant places such as USA or Australia. Olive oil miles were very important to most of FG participants because they felt that olive oil sourced from nearer countries was likely to be the freshest product. Just two participants stated that they were familiar with Spanish brand such as Carbonell. Participant (P_{FG}. No 4) said ***"In some stores such as Sainsbury's, the way of representing the product can play an important role of selection. For example, you can see the brand name product from different countries on the eye level shelf and the store's own product on a lower shelf…"***

Participants were asked whether they would buy organic olive oil of Syrian origin if it were to be available in the market. Two participants stated that they may try the product first (mainly on account of the difficult situation prevalent in Syria) and then decide on repeat purchases. Figure 5.2 presents that five participants (60%) pointed out that the brand name of olive oil means country of origin, according to that, they prefer Italian olive oil brand names, while two participants (20%) prefer Spanish olive oil. The last two participant chose two brand names based on countries of origin, Italian and Syrian olive oil. No one had any preference for Greek olive oil.

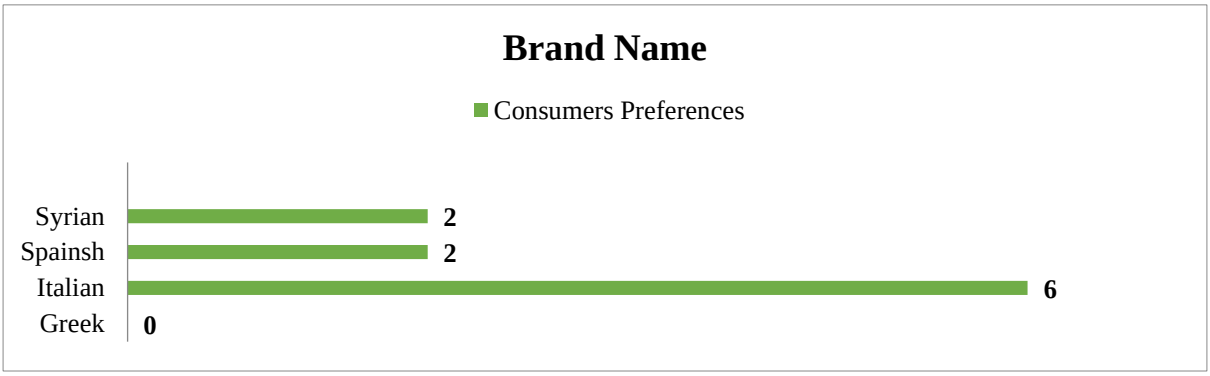

Figure 5.2: Consumer Preference for Olive Oil Brande Name
Source: Focus Group Discussion, 2013.

5.12.5 Taste of Olive Oil

Some the participants stated that they had no sensory experience of the taste of olive oil itself. Participant (P_{FG}. No 3) said ***"I haven't tasted olive oil as olive oil, I used it with cooking and***

dressings, but never had it alone…" Some of the participants stated that the taste of olive oil depended on the purpose for which it was being used. Participant (P_{FG}. No 2) said ***"Sometime the taste of olive oil depends on what process it has been through".*** However, the preference for olive oil was not based on its taste, participant (P_{FG}. No 8) said ***"I am not massively keen on the taste of olive oil … I don't like the oily texture so I use a minimal amount of it".*** It was seen from the discussion that the most common positive comments on the taste of olive oil referred to its ***"Fruity" "Oily"*** or "***Nutty"*** taste or referred to it as being ***"Strong"*** or ***"Pure"***.

5.12.6 Colour of Olive Oil

Participants also looked for a good colour in olive oil. Figure 5.3 shows that three participants preferred dark green olive oil and six participants prefer green olive oil. None of the participants preferred using yellow olive oil in meals because it reminded them of everyday cheap oils. The participants believed that there was a difference between the taste of the yellow olive oils and the green olive oils. It appeared to be the common perception that yellow olive oil has less flavour. One participant was not sure that the yellow olive oil which has a subtle flavour could be appropriate for meals. Participant (P_{FG}. No 6) said ***"I am not quite sure that the yellow olive oil is good for my meals, but it might be suitable for some dishes especially if the oil has a subtle flavour".*** Also, all participants agreed with each other that the colour of olive oil was not an indicator of high quality. Moreover, most of participants did not know the reasons for differences in colour of different olive oils.

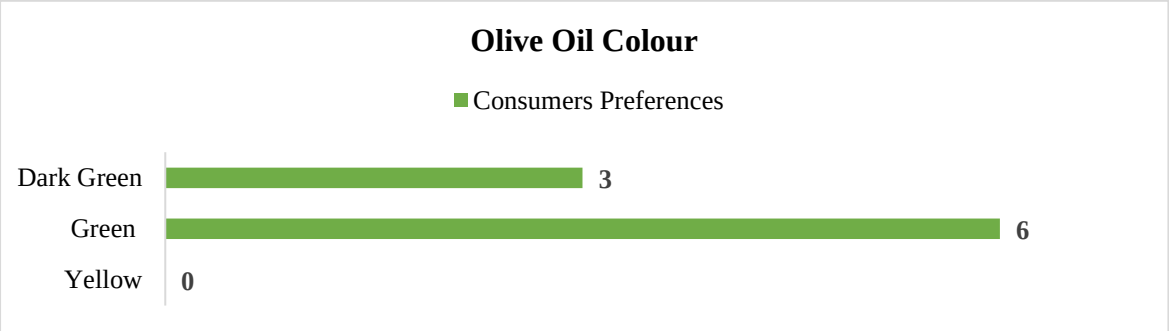

Figure 5.3: Consumer Preference for Olive Oil Colour
Source: Focus Group Discussion, 2013.

5.12.7 Shape of the Bottle (Packaging) & Size of the bottle

Packaging material: the vast majority of focus group participants preferred olive oil in dark glass bottles to keep the oil safe from the light. None of the participants preferred the plastic or transparent glass packaging. None of them expressed a preference for metal packaging (which usually only used for large volumes). The FG participants did not care much about the shape of the bottle, while for size most participants preferred olive oil in 500 ml packaging.

5.12.8 Flavour / Aroma of the product:

Most participants stated that the flavour of olive oil played an important role in purchase decisions. When olive oil is used for cooking, if the flavours of other food ingredients are likely to be overpowered by the flavour of olive oil, then the participants would prefer to use less expensive olive oil. However, for some specific meals such as pasta, pizza, they would prefer to use olive oil with stronger flavour. The large majority of the participants preferred olive oil with garlic or peppery (chilli) flavour more than any other flavour, while a minority of the participants preferred the plum. Basil, rosemary and blood orange flavour were not preferable by respondents at all.

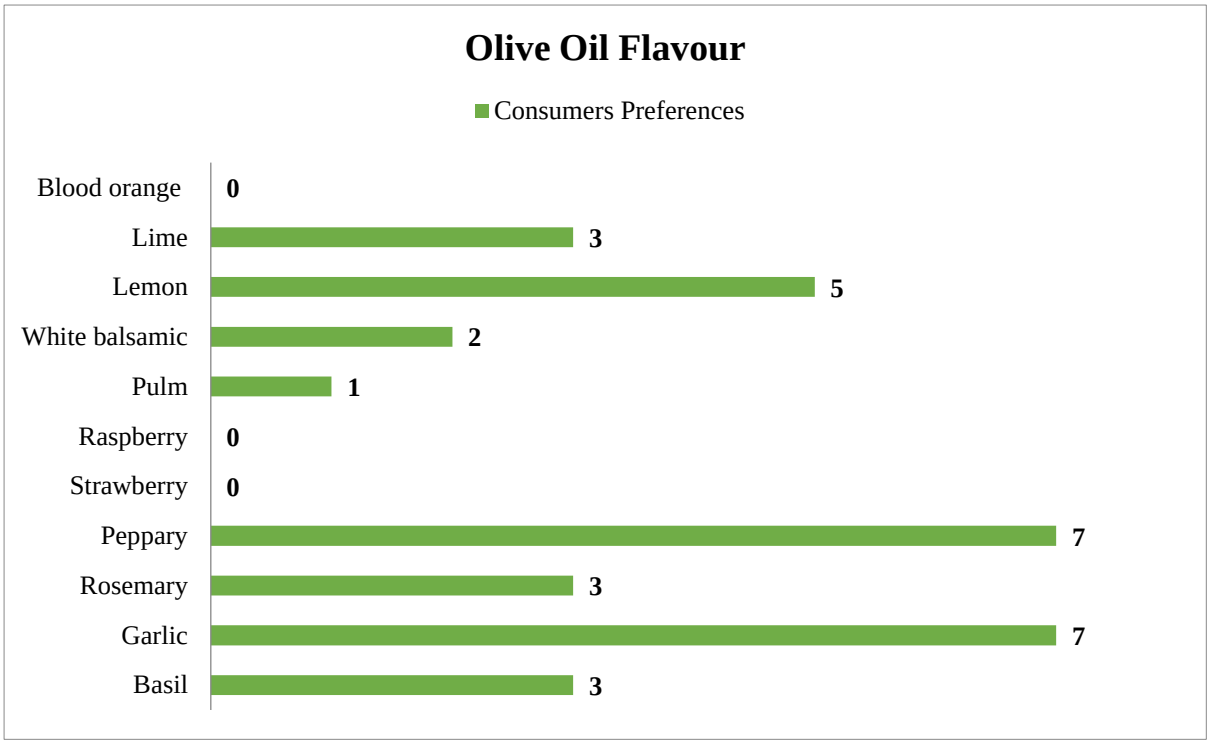

Figure 5.4: Consumer Preference for Olive Oil Flavours.
Source: Focus Group Discussion, 2013.

5.12.9 Price of Olive Oil

The main factor that affects consumer decision-making when purchasing olive oil was the price. Most of participants preferred to buy smaller bottle of olive oil (on account of lower cost) even though the price per ml may be higher (and hence less economical). However, participants expressed their propensity to pay money in different ways, they probably considered that olive oil bottle with a low price represents inferior quality. On the other hand, they considered the higher price of the bottle of olive oil is an indicator of high quality. Most of the participants stated that the price of olive oil was a very important consideration especially if the olive oil was for personal consumption. The intended use of the product also affected the price which participants were willing to pay. At the same time, some participants did not consider that a

higher price was a signal of a higher quality product. If the market were to offer a lower price for extra virgin olive oil, then they would not care about other attributes of the product. They would not be willing to pay a price premium for any kind of olive oil except on some occasions such as Christmas or Easter, Participant (P_{FG}. No 1) said ***"If there is an occasion such as Christmas, I will pay more for the packaging regardless of the quality ..."***. Through the discussion, the moderator referred to the possibility of introducing a new source of olive oil to the market such as organic Syrian olive oil to explore whether the participants would accept a new product and to what extent they would be willing to pay more. Most of participants showed an unwillingness to buy Syrian olive oil especially if it were more expensive than other olive oil, two participants mentioned that if there were an offer on organic Syrian olive oil, they might buy this product.

In summary, focus group discussions played a crucial role in identifying the relevant attributes of olive oil products considered by consumers in making purchase decisions. The identification of the key attributes and their levels from the FGD was an important input for the design of the choice experiment. The FGD gave a good understanding of how British consumers perceive olive oil in terms of its health and nutritional benefits. An understanding of how British consumers perceive and value different attributes of olive oil could provide pointers for the introduction and marketing of organic olive oil sourced from Syria.

5.13 The Planning and Organization of Verbal Protocol Interviews

In addition to the FGDs, the qualitative elements of this study included ten interviews the contents of which were analysed using verbal protocol analysis (henceforth VPA) (See Appendix 3). It was used as a supporting method to identify the attributes of olive oil and their levels. Interviews were conducted at different places with consumers who were current or previous consumers of olive oils. Attempts were made to conduct video record interviews in different stores such as the Co-operative, Marks and Spencer and Waitrose, but the necessary permissions could not be obtained. The interviews conducted in Costa Café, Starbucks, with the moderator providing many samples of olive oil bottles, the participants were selected in terms of the British nationality and previous use of olive oil. They received a consent form by email determining the time, the place and the date of the interview. All interviews were tape recorded.

Before the interview was recorded, it was explained to the participants that they were to put into words their thought processes while purchasing olive oil products. During the interview, participants were asked to verbalize their preferences, experiences, thoughts, and beliefs regarding the selection of olive oil in their purchasing process and what lay behind their

purchasing decisions. Each interview lasted between 10-15 minutes. After completion of all the interviews, they were individually transcribed for detailed analysis. All these interviews were between 14th of September and 17th of October 2013. One of the interviews could not be transcribed as it was inadvertently deleted.

Theoretically, the implementation of VPA is considered a rigorous method to help elicit the thought sequences of the participants. VPA helps in understanding the participants' thinking and how they evaluate a new product on the market against all available alternatives in order to make informed choices. Although an effort was made in the interviews to elicit the natural thought sequences of the participants in the context of purchase decisions. Participants were helped to verbalise their thoughts through prompts related to different brands and grades of olive oil, their attributes and the packaging task analysis, in the light of the participant's knowledge, experience and ideas. This is a crucial stage to process the entire information after doing the VPA. Therefore, applying the verbal protocol process method will help to find answers to our research objectives.

After doing all interviews, the practical implementation of VPA helped to identify olive oil attributes and their levels from consumers' thoughts, opinions and beliefs. VPA gave this research value and useful information due to the richness of its data, and it was a good practice to limit the bias of researcher in interfering with the discussion and influence the consumers' opinions. This made VPA method to be capable of meeting the objective of this research. Our findings are starting with the purposes of using olive oil product for daily life use by the participants.

5.14 Analysis Technique of Verbal Protocol Discussion

VPA is a method of analysis of verbal or behavioural data. The protocol is "verbal report" or a set of utterances or speech made by individual. It can done under specific conditions to service the objective of the research. Bainbridge and Sanderson, (1995) pointed out that there is no way to test directly whether there is correlation between what the individual thinks and what the individual says. Briefly, the process of verbal protocol analysis shown in figure 5.5:

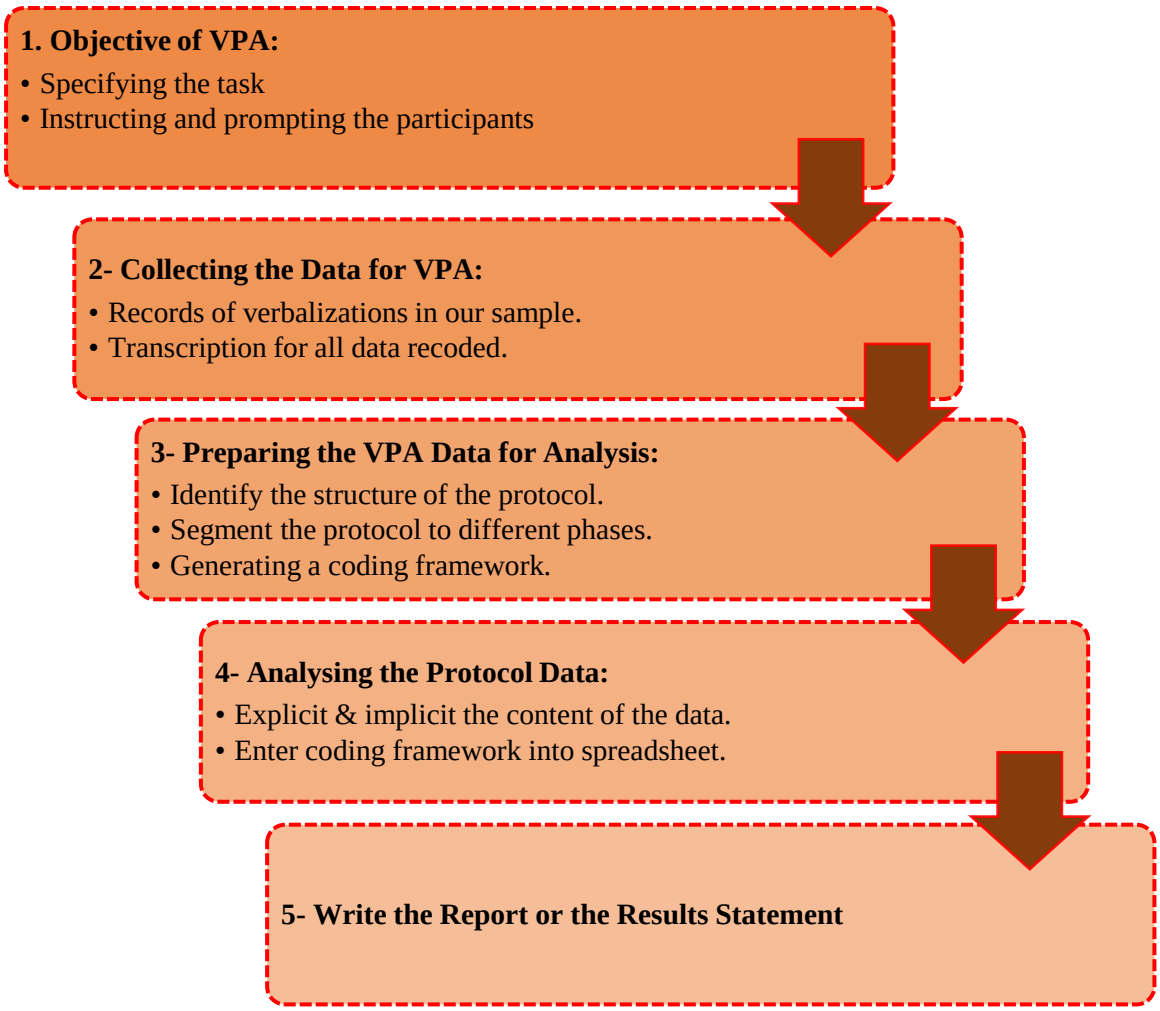

Figure 5.5: Process of Verbal Protocol Analysis.

As may be seen from figure 5.5, the process of verbal protocol analysis involved the following steps: **First,** the aim of exercise is specified which in the present study was to identify the attributes of olive oil and their relevant levels. **Second**, participants were asked to think out loudly while performing the task of choosing olive oil product and all the information and comments were recorded and then transcribed. **Third,** the structure of the protocol analysis was identified. Bainbridge and Sanderson, (1995) state that identification of the structure of the protocol can be done at many levels: first, record the verbal protocol interview and write some notes with pencil marks about many general stages of the protocol activity, finding different

units of activity within each stage, finally dividing the material in each unit of the protocol into a sequence of elemental phrases. After identifying the protocol structure, the protocol was segmented into different phases or units to identify the meaningful verbal description. Finally, the coding framework (which varies from study to study) was generated based on the research objective. The coding framework needs to be developed in related to the theoretical perspective.

The **fourth** stage involved analysis of the data. It is suggested in the literature that it could be useful to use highlighters and marginal notes to mark the important points and sometimes the irrelevant points should highlighted as well to see where the gap in completing the task lies (Lewis and Mack, 1982). The Content analysis method typically includes counting frequencies of occurrence of chosen words or encoding categories. Once all the categories were identified, it was laid out on a Microsoft Excel spreadsheet. The spreadsheet provides a good environment for entering and analyzing data (Wilson and Sharples, 2015); it consists of raw/column array of cells which makes it easy to handle multiple streams of information and to retrieve the information stored in the spreadsheet. Then the analyst should define selected parts of the spreadsheet as containing data do certain types such as text, dummy variables…etc, then after that different kinds of excel formulas can be used to perform the task of VPA like *nested IF statement*, *Sum* formula and *percentage* formula. The spreadsheet can store a summary of analyzed data information. Once the analyst has completed all of these stages, the analyst can start writing the report of verbal protocol results.

Wilson and Sharples (2015) explained the limitations of spreadsheet technique in analysing verbal protocol data. The first limitation is not allowed the analyst to perform queries at the same time of doing the task of verbal protocol. Second, the spreadsheet is not connected to data in audio or video type which makes the analysis more difficult by the analyst. Third limitation is that the spreadsheet can offer analysis of time series while it does not offer for the sequential data analysis where the analyst needs to analysis verbal protocol data.

5.15 Findings from Verbal Protocol Interviews

The key findings form VPA are discussed under several themes. First, we investigate the main purposes for which consumers use olive oil products. We then we explore attitudes to, and knowledge of, organic and non-organic olive oil. Finally, we explore the cues about the most important attributes of olive oil and their levels. Quotes from the participants are in bold italics format.

5.15.1 Purposes of Using Olive Oil Product

The participants mentioned in their interviews that they used olive oil product in for different purposes. It can be seen from figure 5.6 below which shows the relative importance of different uses of olive oil: most of participants pointed out that the main use of olive oil was for cooking, participant (P_{VPA}. No 2)[50] said: ***"I know that the olive oil is a very nutritional product and I use it a lot in cooking and salad dressings or possibly marinating…"***

Around 55% of respondents used the product for salad dressings and marinades and the same percentage to drizzle on vegetables or meat or pasta. Participant (P_{VPA}. No 5) said ***"I tend to like playing with my cooking. If we add some olive oil to mushrooms it tastes quite delicious, I usually use the olive oil for salads and for frying certain products, if product needs to be fried gently with olive oil rather than vegetable oils, it doesn't tend to burn".*** Participant (P_{VPA}. No 3) stated that brushing olive oil while grilling sandwiches was nice and especially delicious with cheese ***"it was quite nice to brush some olive oil with cheese sandwich and heated in a grill".*** In addition, some participants stated that olive oil is used essentially as an ingredient in some dishes. A wide range of ready-made meals and processed foods contain olive oil as an ingredient. However, olive oil is not a superior product which could be used with all meals in daily life. A small number of the participants also pointed out that they used olive oil for baking or roasting food.

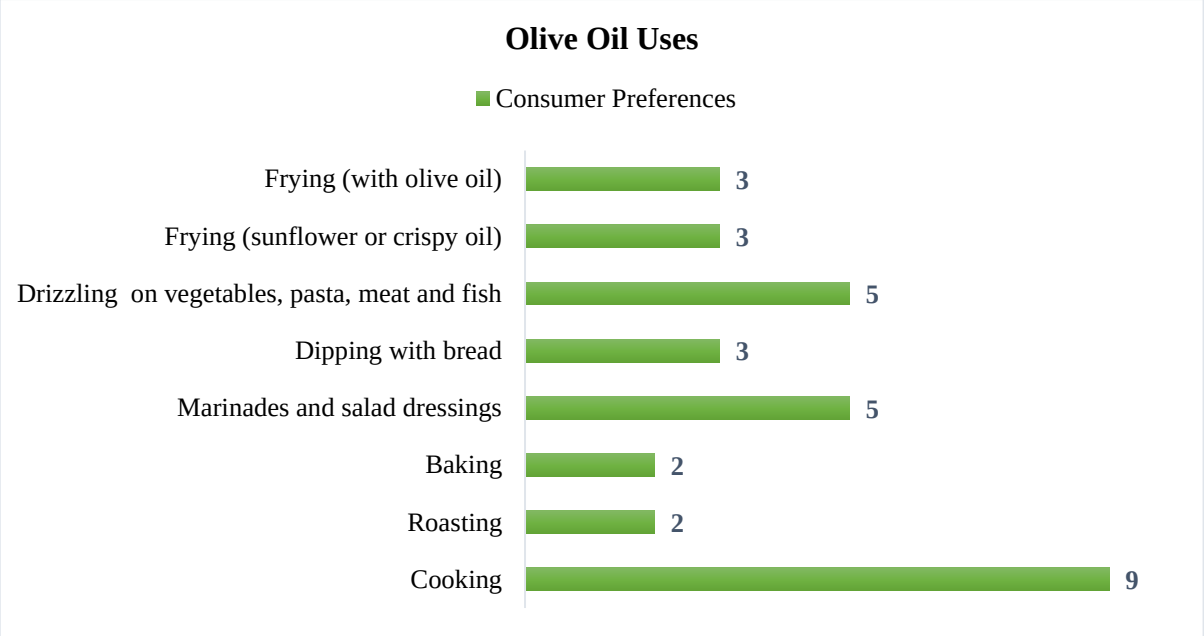

Figure 5.6: Olive Oil Uses

Source: Verbal Protocol Analysis, 2013.

[50] (P_{VPA}. No) is the code I used in VPA data, (P) is for Participant. (No) is the Number of participant.

5.15.2 Some Attitudes and Knowledge of Organic Olive Oil Product

It was noticed from the responses that some of the participants (2 out of 9) did not know the difference between the organic and non-organic olive oil products in terms of their health and nutrition characteristics. However, most of the respondents expressed a desire to use organic olive oil but they were still not sure whether they would buy organic olive oil, participant (P_{VPA}. No 4) stated **"*I would like to use organic but I am not sure I will buy it*".** Some of the respondents who did not prefer to use organic olive oil however, stated that they preferred the organic options for other items like eggs, chicken and vegetables. Participant (P_{VPA}. No 3) said: **"*Not interested to choose organic for olive oil, for other things maybe like chicken, eggs; things like that I will definitely go for organic, I think I do enjoy olive oil, for me it is a stronger flavour if it is organic*."**

Respondents generally perceived organic olive oil as offering health and nutrition benefits and many respondents had previous experience of its use. Participant (P_{VPA}. No 7) said: **"*Organic is more safe and healthy*"** and participant (P_{VPA}. No 1) stated: **"*Low fat content and nutrition*"** some of them they said that they used organic olive oil because it has fewer chemicals in the planting and growing process, participant (P_{VPA}. No 9) said: ***"Less chemical"*** and they have **"*Have previous experience*".** Three participants pointed out that because they have health issues they consume olive oil regularly for everyday use. Participant (P_{VPA}. No 8) said ***"Using olive oil for heath issue".***

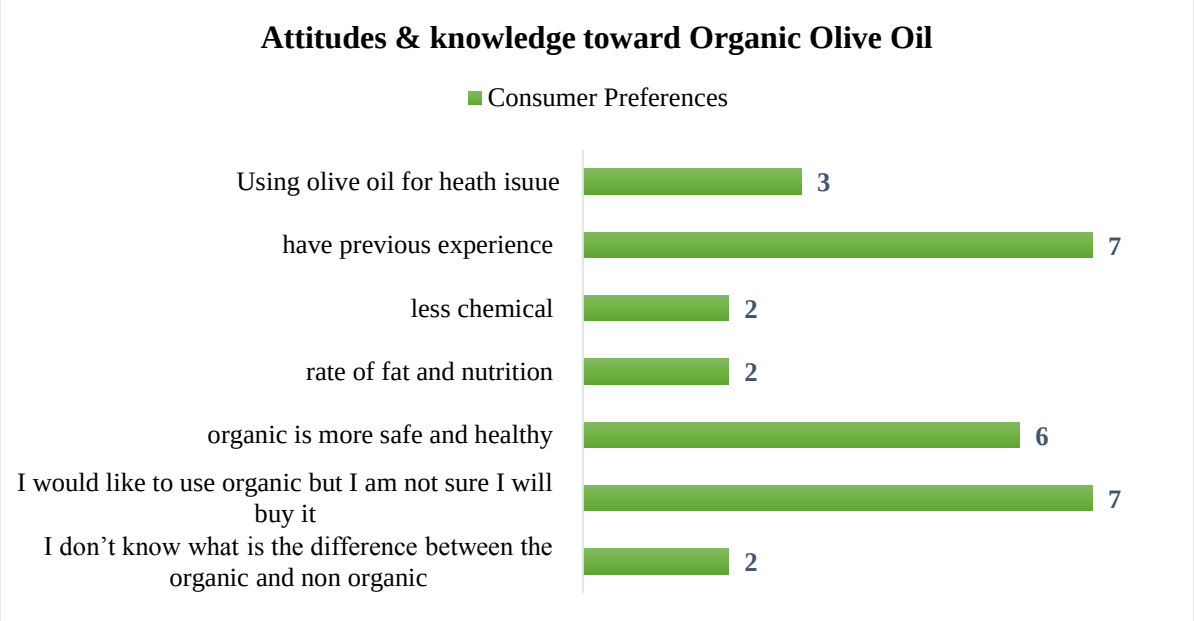

Figure 5.7: Attitudes & Knowledges toward Organic Olive Oil Product

Source: Verbal Protocol Analysis, 2013.

5.15.3 Using Organic vs Non-Organic Olive Oil

Four out of nine respondents were organic olive oil consumers while five participants preferred to consume non-organic olive oil (Figure 5.8). The participants, who consumed organic olive oil, were knowledgeable about the health and nutrition benefits of olive oil. They also mentioned to that an important factor was the increasing availability of organic olive oil in local shops or in the supermarkets, participant (P_{VPA}. No 9) said ***"I think olive oil is quite recently seen in the supermarkets… there are a variety of olive oils including the organic ones"***

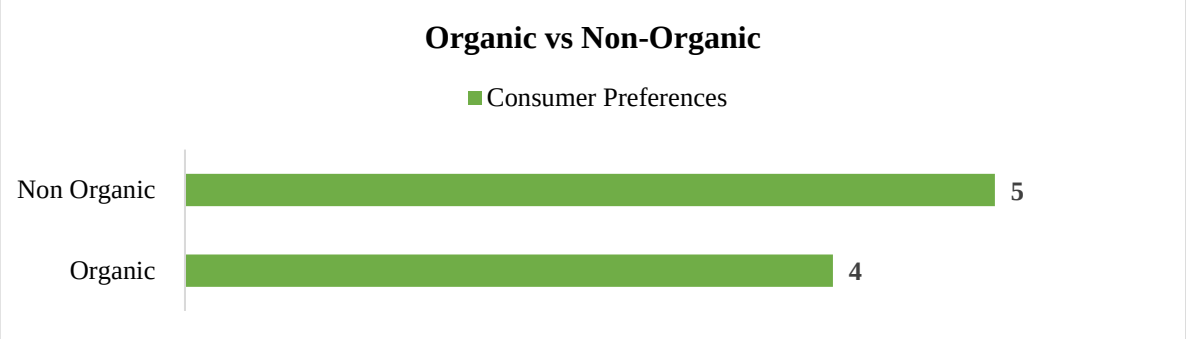

Figure 5.8: Consumer Preference for Olive Oil Organic and Non-Organic
Source: Verbal Protocol Analysis, 2013.

5.15.4 What Does Quality of Olive Oil Mean for You?

When participants are asked to think aloud about their purchase decision, it is quite common for them to pause and stop talking. During these pauses, the participants were prompted to say what they understood by the quality of olive oil. The responses to these prompts are summarised in figure 5.9 below. Most of the participants that they selected olive oil based on the country of origin using either the information on the label or by choosing specific brands. Most participants felt that Italian olive oil was of the highest quality for consumption. Some of interviewees pointed out that the type of the olive oil and how it was processed were important indicators for the quality even though they did not know precisely the differences between different grades of olive oil (Extra virgin or virgin). However, a few respondents indicated that taste was the main indicator of quality. A minority of participants associated quality to the taste and the purposes of using olive oil.

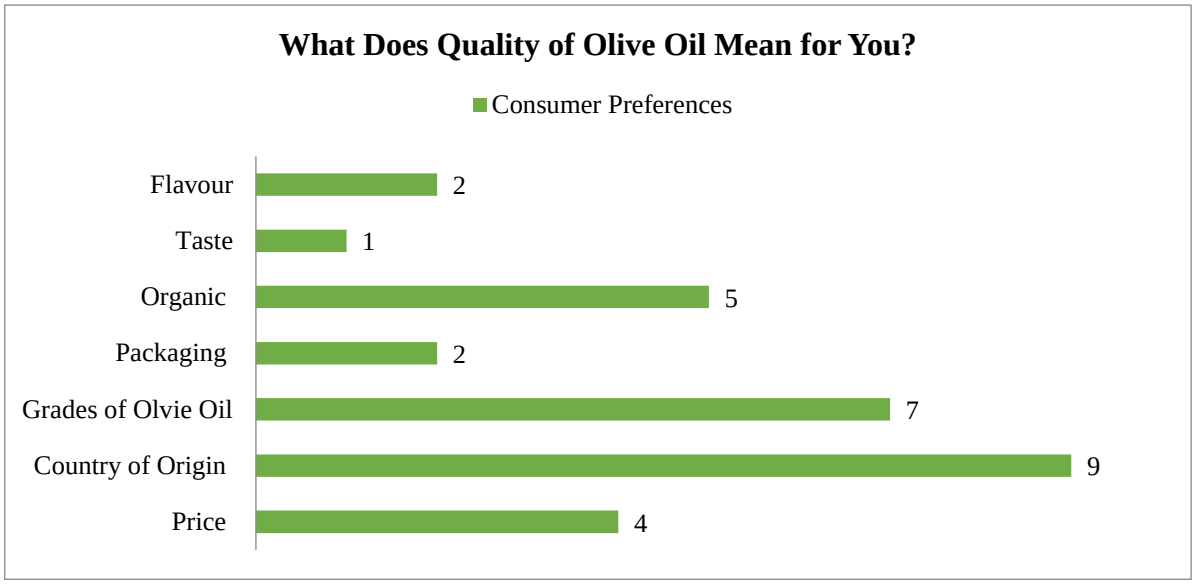

Figure 5.9: What Does Quality of Olive Oil Mean for You?

Source: Verbal Protocol Analysis, 2013.

5.15.5 Type (Grades) Of Olive Oil

Regarding preferences for different grades of olive oil, most participants viewed extra virgin olive oil as a superior product with a strong flavour and mentioned that it was obtained from the first pressing. In addition, they referred to the fact that extra virgin olive oil means that the oil is a pure taste in the mouth. One interviewee stated they have no worries about using the sunflower oil for purposes such as frying because it does not harm the oil, while high heat for extra virgin olive oil will bring it over its smoking point. Two interviewees pointed out that they used the spray olive oil (which is a mixture of different kinds of olive oil) because it was healthy having just one calorie per spray as it appears in figure 5.10.

For less knowledgeable participants or for participants with limited experience of using extra virgin olive oil, the interview process appeared to provide them with new information and modified their perceptions about using olive oil. Moreover, it was noticed from the discussion that the interviewees did not appear to know the difference between different grades of olive oil products, but they consider extra virgin olive oil to be the best. One respondent stated that consumers are not sure how to make choices when faced with several alternatives. Therefore, it is difficult to make trade-offs between different product characteristics.

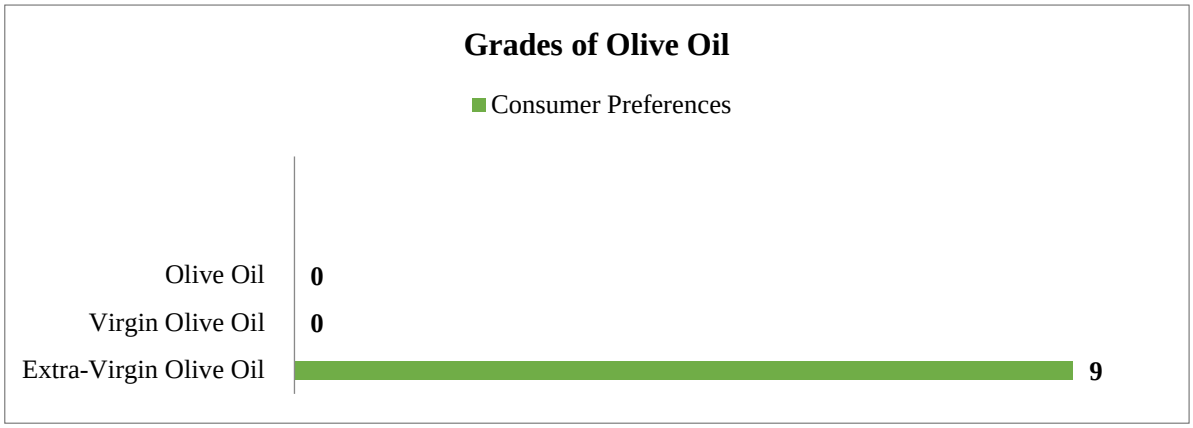

Figure 5.10: Consumer Preference for Grands of Olive Oil

Source: Verbal Protocol Analysis, 2013.

5.15.6 The Brand Name according to Country of Origin

Italian brand names such as Filippo Berio and Napolina were preferred by a majority of interview participants. Some of them were influenced by the Italian brand names as they considered Italian olive oil to be of high quality. However, others mentioned that their choice of brand was based on what their families used previously, but they did not know why exactly they used it. Participant (P_{VPA}. No 2) stated because ***"my wife is from Italy and she knows which olive oil we should use in preparing our meals"***, the same participant answered when were asked; Why Italian? **"*because it's been around a long time and I used to buy and liked it, but it was the most expensive, so I might look again if there is an alternative to the same product*"**. Another participant (P_{VPA}. No 6) said ***"lower miles' travel".*** It can be seen from figure 5.11 that nine participants prefer brand name based on CoO such as Italian olive oil, and the minority of them used supermarkets own brands.

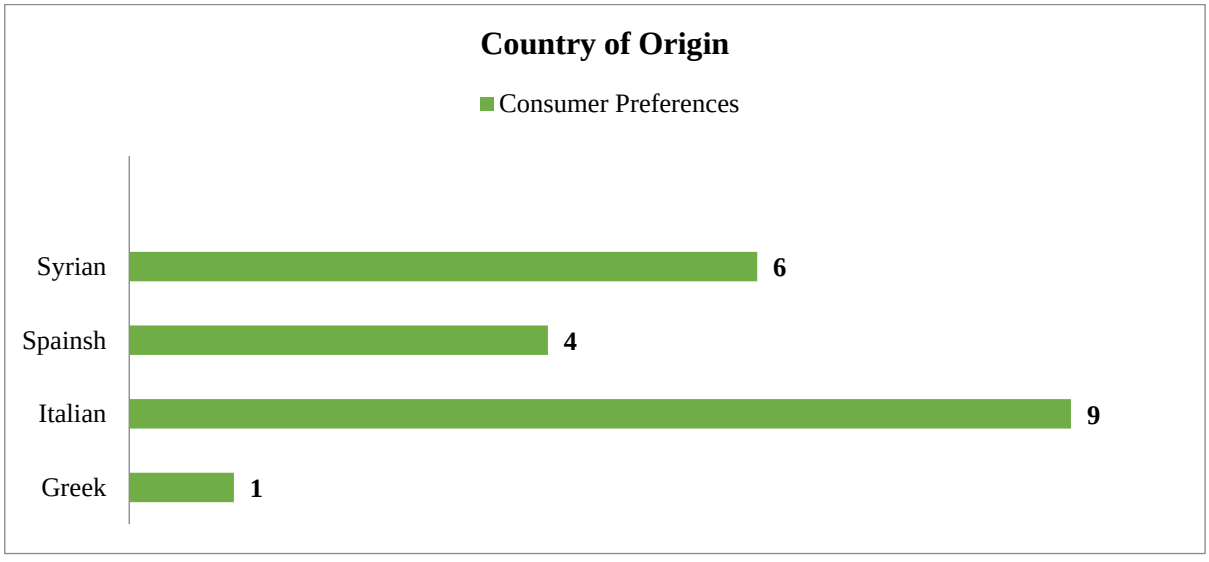

Figure 5.11: Brand Name Based on Country of Origin.

Source: Verbal Protocol Analysis, 2013.

5.15.7 The Type of Olive Oil Bottle (Packaging) and Storage

Participants appeared to feel that olive oil was ideally stored in a dark place for periods of up to a year. They generally stored olive oil in cupboards where it was cold and dark or alternatively they stored olive oil bottles in in the refrigerator. They noticed a change in the texture of oil when it was stored in a refrigerator. Participant (P_{VPA}. No 7) said: ***"It is stored in a cold place, it starts to change by getting cloudy and blurred. I am afraid to use it".*** They felt that sunlight might affect the quality of olive oil, thus they preferred to choose dark coloured bottles for olive oil. On the whole, participants preferred olive oil in glass bottles due to flexibility to recycle it. Participant (P_{VPA}. No 8) said ***"glass is more recyclable".*** Glass containers for olive oil were also preferred (on health safety considerations) over plastic ones. Only one participant with five family members preferred metal containers to store large quantities of olive oil.

Figure 5.12: Consumer Preference for Olive Oil Packaging.

Source: Verbal Protocol Analysis, 2013.

5.15.8 Olive Oil Colour

During the discussion, a variety of olive oil bottles and cans were shown to participants to elicit comments. 40% of the interviewees preferred the dark green olive oil colour, while 33% preferred the light green colour. Only a very small percentage of the participants preferred the yellow one.

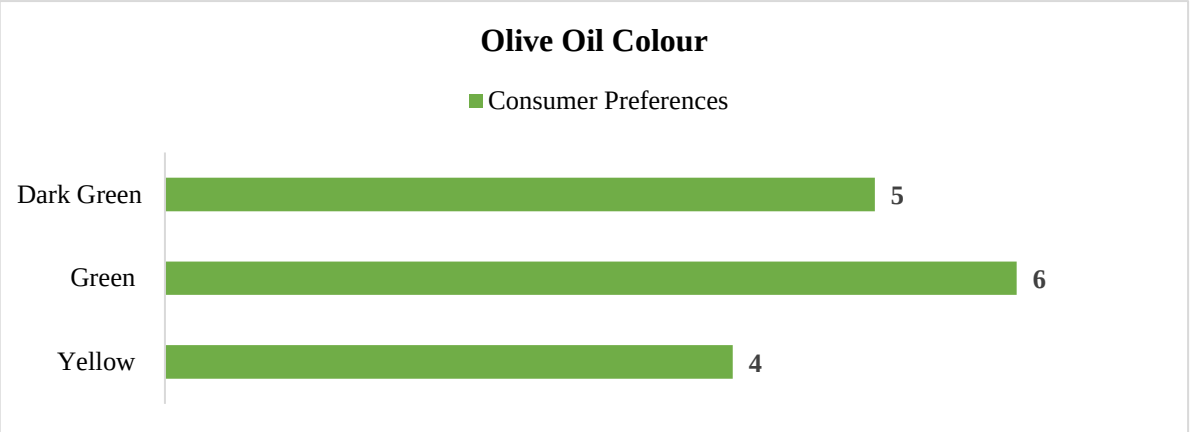

Figure 5.13: Consumer Preference for Olive Oil Colour

Source: Verbal Protocol Analysis, 2013.

5.15.9 Taste of Olive Oil

The participants described the taste of olive oil using expressions such as such as "pure", "strong", "fruity", "smooth" "not harsh" …etc. The majority of interviewees mentioned that the "pure" taste was their favourite while the fruity taste was nice especially with salad. A few mentioned that they preferred the "bitter" taste or the "strong" one. Participant (P_{VPA}. No 1) said: ***"I like a smooth olive oil not harsh olive oil; I think that influenced me in the taste with a little on bread or just put it on pasta".***

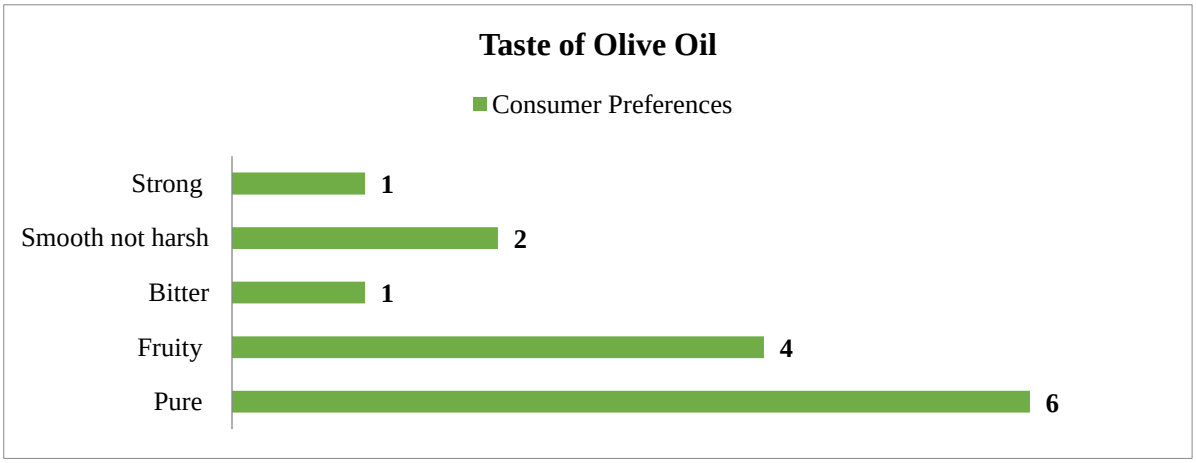

Figure 5.14: Consumer Preference for Olive Oil Taste

Source: Verbal Protocol Analysis, 2013.

In summary, verbal protocol analysis is an effective method for assessing the cognitive processes of consumers by making participants to think aloud (verbalise their thoughts and feelings) to understand their product perceptions and their purchasing decisions. While VPA has certain limitations, alluded to in Chapter 4, it is nevertheless, a flexible methodology that provides rich insights into consumer behaviour.

5.16 Olive Oil Attributes and Levels

Based on the obtained results from FG discussion and VPA, crossing these results together to determine the most important attributes, which will be used in the application of choice experiment. In addition, literature review related to empirical studies of olive oils products will used to help in determining the attributes of olive oil. Finally, for the price attribute, the real observation of price attribute levels is made in UK market and it helped to inform the levels of the price attribute. Table below determined the most important attributes used in the application of choice experiment.

Table 5.3: The Attributes Are Used in Discrete Stated Preference Choice Experiment.

Attribute	**Levels**	**Description of the levels**
Organic	2	Organic, Non-Organic
Country of Origin	4	Italian, Spanish, Syrian, Greek
Colour	3	Yellow, Green, Dark Green
Packaging	2	Glass, Plastic
Flavour	3	Fruity, Nutty, Bitter
Type (Grades)	3	Extra virgin, Light, Standard
Price	5	£2, £3.16, £5.30, £4.99, £6
Taste & Intensity	2	Strong, Smooth
Fairtrade	2	Yes, No

Data Source: Focus Group Discussion &Verbal Protocol Analysis, 2013.

However, some other information have been formed from both methods are not considered important as much as the previous attributes. Therefore, it is excluded from this study such as:

1) The lid of olive oil bottle.
2) The expiry date, or best before.
3) The health issues.

Chapter Six: Results and Discussion

6.1 Introduction

Chapter Six contains the empirical analysis for the thesis. Descriptive statistics from the survey data are presented in the first section. In the second section, debriefing questions included in the survey are analysed by using Probit and Ordered Probit models. The role of price as an indicator of quality for olive oil is then examined, along with the estimates from the Mixed Logit models. The interpretation of willingness to pay estimates are discussed in the last section.

6.2 Descriptive Statistics

The data is drawn from online DCE survey to elicit British consumers' preferences toward organic olive oil in general and to Syrian organic olive oil specifically. The survey structure is included in section 5.5 of chapter five, and in more details in Appendix 4. A nationally representative survey across the UK was conducted in January 2015, with 414 respondents who were classified according to their British nationality and their preferences when buying olive oil products. Descriptive statistics were used to give a brief summary of socio- economic characteristics of the data set including gender, age group, marital status, number of children living in their household, highest level of education attained, and the main source of income. Sample descriptive is given in table 6.1.

Table 6.1 presents the descriptive statistics for the socio-economic characteristics of respondents. The gender ratio of the 414 respondents is nearly proportional, with 50.2 % male and 49.8% female. The age group is divided into three different ages bands, one between ages 25-34 taking 26.8%; another between ages of 35 - 44 taking around 27.8%, third group with ages ranging between 45-54 (114 respondents) which represents 27.5% out of the whole sample. Other age groups are only 0.2% of the sample size.

With regard to the level of education attained, 36 % of the respondents have an undergraduate degree, 34.5% completed secondary education, and 20.5% have a postgraduate degree. A minor portion of the respondents 1.2% had only completed primary education, while the rest of the respondents preferred not to answer this question.

In terms of the marital status, more than half of the sample are married, representing around 59.7 % and around a quarter of the sample, with a frequency of 118, identified as single, representing 28.5 % of the sample. The rest of the sample are in different situations such as divorced 5.3 % and widowed 0.2 % and in a civil relationship 4.6 %. However, seven respondents preferred not to answer the question.

From the table, around half of the sample do not have children while only 6 out of 414 respondents have over three children. In terms of main source of income, most of the sample get salary a 79.5% as a main source of income, while 6.8% of the respondents depend on support resources for their income. Only 17 respondents chose not to disclose any information about their source of income.

Table 6.1: Descriptive Statistics

Sample Characteristic	Frequency (N= 414)	Percent (%) (N= 414)
Gender		
Male	208	50.2
Female	206	49.8
Age Group (Years)		
18-24	1	0.2
25-34	111	26.8
35-44	115	27.8
45-54	114	27.5
55-65	71	17.1
Over 65	1	0.2
Prefer not to answer	1	0.2
Marital Status		
Single	118	28.5
Married	247	59.7
In Civil Partnership	19	4.6
Divorced	22	5.3
Widowed	1	0.2
Prefer not to answer	7	1.7
Number Of Children Living In Your Household (Child)		
0	216	52.2
1	93	22.5
2	73	17.7
3	22	5.3
Over 3	6	1.4
Prefer not to answer	4	1.0
Number of People in Your Household Including Yourself (Person)		
1	63	15.2
2	135	32.6
3	94	22.7
4	84	20.3
5	29	7.0
Over 5	5	1.2
Prefer not to answer	4	1.0
Highest Level of Education Attained		
Primary	5	1.2
Secondary	143	34.5
Tertiary- Undergraduate	149	36.0
Tertiary- Postgraduate	85	20.5
Other	27	6.5
Prefer not to answer	5	1.2
Main Source of Income		
Salary / Pension	329	79.5
Rental or Investment Income	13	3.1
Income Support /Benefits	28	6.8
Other	27	6.5
Prefer not to answer	17	4.1

Source: Survey Data, 2015. *n* = 414 Respondents.

6.3 Debriefing Questions Results

This section presents the results from the debriefing questions included in the questionnaire. As explained in chapter five, there are alternative specifications of the mixed logit model (See Chapter 4, section 4.4.3.2 and 4.4.3.3 and 4.4.3.4) that incorporate the debriefing information. These questions give insights into consumer attitudes towards the attributes used in the CE, as well as the way in which people engaged in the survey instrument. Here we summarise and explain stated non-attendance and rankings of attributes using age, size of household, income and gender.

6.3.1 Occurrence of Stated Attribute Non-Attendance in Choice Experiment

There has been a fast growth of literature investigating how respondents interact and choose attributes engaged in CE application (see section 3.4 in Literature review). In the early CE literature, it was widely assumed that respondents would consider all attributes when making their decisions. However, it is likely that some respondents will ignore some attributes when making choices. This behaviour is called Attribute Non- Attendance (AN-A). Respondents answered a debriefing question, of a Yes / No type as to whether they attended or did not attend each attribute. This section explains the number and proportions of respondents who indicated that they ignored (did not attend to) some attributes in CE.

Table 6.2 shows that out of the 412 respondents, a small fraction of them (16) have stated that they did not ignore any attribute in the choice card they were given. Only 3.88% of the respondents considered all attributes in making their choices, which indicates that as high as 96.12 % (396 respondents) reported ignoring at least one attribute, making stated AN-A a dominant behaviour. The high proportion of respondents reported to have ignored attributes provides a good justification for accounting stated AN-A in our model estimation. In some studies, it is quite usual to notice that a small proportion of respondents actually consider all product attributes (Campbell and Lorimer, 2009; Carlsson *et al*., 2010; Hensher *et al*., 2007).

However, results in the same table show that the majority of respondents (150, amounting to 36.41%) ignored only one attribute. Ignoring more than two attributes could be normal and reasonable due to using a high number of attributes in CE, which demand a higher cognitive effort in choosing the preferred option. This result is supported by Carlsson *et al*., (2010). Alternatively, the attributes of the product might be irrelevant to what the respondent would like to choose. Thus, she/he tried to ignore more than one attribute. The tendency to ignore more than one attribute is reflected in the same table, as 22.09 % for neglecting two, 18.69 % for three, and 10.44 % for four. In their research Campbell *et al.*, (2008) found that 36% of individuals stated that they ignored at least one attribute in a survey conducted to improve rural

landscape attributes in Ireland and the magnitude of WTP for each attribute will decrease. Puckett and Hensher (2009) conducted a study in Sydney revealing process heterogeneity in choice experiments. They found that there is heterogeneity regarding AN-A across respondents and across choices, and that the behaviour of ignoring some attributes will affect WTP estimation.

On close inspection, table 6.2 reveals that none of respondents ignored the whole set of nine attributes on the choice set, and a further eight respondents (1.94%) said that they ignored eight attributes and focused only on one attribute, which indicates that the respondents are not willing to make trade-offs between attributes. Results from previous studies pointed out that not all respondents consider all attributes, and AN-A can crucially bias coefficients and affect WTP estimation. Recently, estimating a discrete choice modelling taking into account AN-A has started a discussion about the reasons stated for ignoring some attributes in CE. Scarpa *et al.*, (2009) and Hensher (2010) have attributed the incidence of AN-A to using simple methods, such as heuristics, when the choice sets are complex or some respondents may only consider a level of attribute. Overall, the majority of respondents reported ignoring at least one or two attributes when making their decision in the CE. This is a reason to consider that the CE had reasonable and realistic results in terms of AN-A model.

Table 6.2: Number of Stated Attributes Non-Attendance (Ignored) by Respondents.

Number of Attributes Ignored	Number of Respondents	% of Respondents
Zero	16	3.88
One	150	36.41
Two	91	22.09
Three	77	18.69
Four	43	10.44
Five	14	3.40
Six	10	2.43
Seven	3	0.73
Eight	8	1.94
Nine	0	0
Total	412	100

Source: Survey Data, 2015. n = 412 Respondents.

6.3.2 Probit Model Estimates

To understand better the observed heterogeneity between respondents, in this study, the probit model examines the determinants of attributes stated attendance (or non-attendance) through different categories of socio-demographics characteristics (age, income, size of household and gender). The probit model includes dependent dichotomous variables, which equal zero for attribute non-attendance (negative signs), and equal one for attribute attendance (positive signs). The model also includes four independent variables, which represent socio-demographic

characteristics (age, income, size of household and gender). The probit model was run separately for each attribute. The results obtained from the probit model helped explain how the socio-demographic variables influence the probability of stated attendance (or non-attendance) for a given attribute.

There are two approaches for interpreting the impact of explanatory variables within Probit models, the "marginal effects" and 'log-odds' coefficients. Here we present only the 'log-odds' coefficients along with the significance of each of the coefficients since we are only interested in whether a particular explanatory variable has an impact on stated attendance, rather than a more careful analysis of how this impact on latent "utility". Table 6.3 gives the posterior mean, standard deviation and pseudo *t*-statistic from the Probit model results.

In terms of age group, it is noticed from table 6.3 that UK respondents have positive signs of utility for some attributes such as organic (posterior mean $_{organic}$ = 0.483), CoO (posterior mean $_{CoO}$ = 0.044), fairtrade (posterior mean $_{fairtrade}$ = 0.812) and price of olive oil (posterior mean $_{price}$ = 0.666). This indicates that the older respondents are less likely to ignore organic product, CoO attribute, fairtrade and price of olive oil than younger people when answering the CE. Older British people have a high propensity to buy organic olive oil and consider CoO, whether fairtrade or not and the price in their purchase. This result seems plausible because older people are more concerned with health and safety issues related to food choice. However, the younger British respondents exhibit negative signs toward some attributes such as taste (posterior mean $_{taste}$=-0.435) and packaging (posterior mean $_{packaging}$ = - 0.045)…etc, this indicates that younger people are more likely to ignore these attributes in their purchase than older people are.

In regards to the income category, table 6.3 indicates that British consumers with a higher income were more likely to consider most of the olive oil attributes rather than the people with lower income. On the other hand, UK respondents with higher incomes were more likely to ignore the flavour of olive oil (-0.002) and the taste attribute (-0.028), than the respondents with lower income. It appears that the income category has significant influence on consumer preferences of olive oil in order to be attendant to the attributes. These results in accordance with Shin *et al.*, (2015).

The size of the household has the opposite effect on the probability of ignoring attributes of olive oil. From same table, small - sized families, without having children (or single people) have a positive preference for three attributes, which are CoO (posterior mean $_{CoO}$ = 0.004), taste of olive oil (posterior mean $_{taste}$ = 0.015) and fairtrade (posterior mean $_{fairtrade}$ = 0.022). This indicates that smaller sized families are less likely to ignore those three attributes as opposed to

larger sized families. However, the large-sized families exhibit negative signs of utility for the most of olive oil attributes. For example, with an additional child in the household, larger sized families are more likely to ignore the organic attribute (posterior mean $_{organic}$ = - 0.003) than smaller sized families. This indicates that the propensity to purchase organic olive oil decreases. It might be related to the household income or it might be because organic products are more expensive than traditional olive oil. It seems that the size of the household had no significant influence on the preferences of British consumers.

Among participants of the male gender, it is noticed from the table that British respondents have a positive significant impact on the probability of choosing packaging (posterior mean $_{packaging}$ = 0.368), flavour (posterior mean $_{flavour}$ = 0.275), taste (posterior mean $_{taste}$ = 0.259), fairtrade (posterior mean $_{fairtrade}$ = 0.183) and colour (posterior mean $_{colour}$ = 0.017). This indicates that male respondents are more likely to consider all these attributes than women do. Male respondents are also less likely to consider organic, CoO, type and price of olive oil.

Table 6.3: Probit Model Estimates for Attribute Attendance (or Stated Non- Attendance)

Attribute	Intercept		Age		Income		Size of household		Gender/male/	
	Beta (St Dev)	Pseudo *t*-statistic	Beta (St Dev)	Pseudo *t*-statistic	Beta (St Dev)	Pseudo *t*-statistic	Beta (St Dev)	Pseudo *t*-statistic	Beta (St Dev)	Pseudo *t*-statistic
Organic	-2.373 (1.020)	-2.327	0.483 (0.252)	1.914	0.048 (0.091)	0.530	-0.003 (0.054)	-0.047	-0.099 (0.133)	-0.747
CoO	-1.111 (1.005)	-1.106	0.044 (0.249)	0.175	0.176 (0.093)	1.885	0.004 (0.054)	0.082	-0.069 (0.128)	-0.537
Colour	0.251 (0.999)	0.251	-0.140 (0.249)	-0.561	0.013 (0.091)	0.148	-0.054 (0.054)	-0.993	0.017 (0.129)	0.135
Packaging	-0.233 (0.981)	-0.238	-0.045 (0.244)	-0.184	0.027 (0.088)	0.300	-0.009 (0.053)	-0.173	0.368 (0.126)	2.922
Flavour	-0.567 (1.325)	-0.428	-0.214 (0.332)	-0.645	-0.002 (0.119)	-0.013	-0.013 (0.070)	-0.179	0.275 (0.174)	1.575
Type	0.086 (1.190)	0.072	-0.314 (0.296)	-1.063	0.062 (0.111)	0.561	-0.026 (0.064)	-0.408	-0.201 (0.155)	-1.296
Taste	0.290 (1.316)	0.220	-0.435 (0.331)	-1.315	-0.028 (0.116)	-0.240	0.015 (0.069)	0.214	0.259 (0.172)	1.508
Fairtrade	-4.056 (1.054)	-3.850	0.812 (0.259)	3.140	0.120 (0.094)	1.276	0.022 (0.055)	0.390	0.183 (0.132)	1.383
Price	-3.936 (1.350)	-2.916	0.666 (0.332)	2.006	0.079 (0.117)	0.678	-0.012 (0.071)	-0.163	-0.032 (0.167)	-0.191

Source: Survey Data, 2015. *n* = 412 respondents.

Note (*) Pseudo *t*-test significant at 5%, within Bayesian inference, the coefficient's confidence interval excludes zero if the ratio of the estimate of the mean to the standard deviation exceeds 2.

6.3.3 Ranking Attributes in term of Non-Attenders and Attenders and T-Test for No Difference

In another debriefing question included in the CE, respondents were asked to rank attributes in terms of their importance for their choice. Table 6.4 presents the ranking data set in terms of attendance and stated non-attendance attributes in the first two columns. The third column presents *t*-test to assess whether the means of two groups (stated non- attendance and fully attendance) are statistically different from each other. It allows comparison of the means for those two groups.

Looking at the first column, British respondents, who gave high importance ranking to some attributes such as CoO (mean $_{CoO}$ = 6.34), fairtrade (mean $_{fairtrade}$ = 6.14) and packaging attribute (mean $_{packaging}$ = 6.11), are less ignored for these attributes. This indicates that the stated AN-A and IR-A are consistent and realistic. However, it can be noticed in the second column that British people gave high importance ranking to some attributes such as fairtrade (mean $_{fairtrade}$ = 5.605) and packaging (mean $_{packaging}$ = 5.147). This indicates that the highly-ranked attributes were consistent with the most attended attributes.

In terms of *t*-test for no difference, it is clear from table 6.4 that the statistical difference of the mean rank between attenders and non-attenders is significant for organic, country of origin, colour of olive oil, package, type and price. However, the statistical difference of mean rank between respondents who attend and non-attend is not significant for attributes which are ranked as important attributes for the respondents (i.e. Flavour olive oil and taste of olive oil). Moreover, the fairtrade attribute shows that statistically significant on 10%. In addition, the price attribute, ranked in the third position of importance in table 6.6, represents statistically significant on 1%. This concurs with the *a priori expectation* from the respondents' answers. In the olive oil market, taste and flavour are the most important attributes, which should be taken into account.

Table 6.4: Mean Rank by Stated Non-Attenders and Attenders and T-Test for No Difference.

Attributes	Mean Rank Non Attenders (AN-A)	Mean Rank Attenders (AF-A)	T-Test for No Difference
Organic	5.866	4.953	3.110***
CoO	6.340	4.916	5.329***
Colour	5.797	4.958	3.625***
Package	6.110	5.174	3.788***
Flavour	4.705	4.160	1.594
Type	5.540	4.599	2.972***
Taste	4.733	4.422	0.792
Fairtrade	6.147	5.605	1.900*
Price	5.729	4.354	2.854***

Source: Survey Data, 2015. *n* = 412 respondents.
Note: Statistically significantly different at 10% (*), 5% (**), and 1% (***).

6.3.4 Ordered Probit Model Estimates

An ordered probit model was estimated to explain how socio-demographic variables influence the probability of giving a specific rank to an attribute. The ordered probit model included ordered dependent variables for ranking attributes (first in rank as the most important followed by second, and so on and so forth). The model also included four independent variables that represent socio-demographic characteristics (age, income, size of household and gender). The model was run separately for each attribute. Our approach is to interpret the results obtained from this model in terms of the significance and signs of the coefficients and as with the dichotomous Probit we do not consider marginal effects. Table 6.5 reveals a posterior mean, standard deviation and pseudo *t*-statistic from the ordered probit model results. The outcome of the model also gave the threshold parameters for ranking data (*n-2*). The thresholds are not relevant here and, therefore, the values will not be discussed in this section.

From table 6.5, in terms of age group, the results revealed that older respondents show propensity to ranking organic, colour and fairtrade as the most important attributes to their preferences. Older British respondents are more likely to rank organic olive oil as the first attribute (mean $_{organic}$ = 0.46). This indicates that British people are mainly concerned about health and safety when making choices in regards to food choice. The second and third most important attributes for older respondents were colour and Fairtrade respectively. However, for older respondents, price was the least important attribute. This indicates that older respondents might not consider price as indicator of quality in a product.

Based on the income category, it is observed from the table that people with higher income are more likely to rank the country of origin as the first attribute (mean $_{CoO}$ = 0.131). For these respondents, the organic, fairtrade, colour and packaging attributes are more important than for respondents with lower incomes. However, for respondents with higher incomes, the price attribute was ranked as less important. This result is reasonable and realistic due to giving more importunacy to large numbers of attributes. Respondents with small-sized families and respondents of the male gender have positive insignificant signs and show preference for the taste attribute, often ranking it first (e.g. mean $_{taste}$ = 0.063 for small size of household, mean $_{taste}$ = 0.278 for the males).

As a result, the ordered probit model indicates that British respondents valued the information related to olive oil attributes and used this information when purchasing. The socio-demographic characteristics increased the probability of organic, colour, and packaging being the highest ranked attributes.

Table 6.5: Estimated Order Probit Model for Importance Ranking Data

Attributes	Intercept		Age		Income		Size of household		Gender/male/	
	Beta (St Dev)	Pseudo *t*-statistic	Beta (St Dev)	Pseudo *t*-statistic	Beta (St Dev)	Pseudo *t*-statistic	Beta (St Dev)	Pseudo *t*-statistic	Beta (St Dev)	Pseudo *t*-statistic
Organic	-0.928 (0.804)	-1.154	0.460 (0.200)	2.3	0.065 (0.073)	0.890	0.025 (0.043)	0.581	-0.044 (0.103)	-0.427
CoO	1.123 (0.806)	1.393	-0.035 (0.200)	-0.175	0.131 (0.073)	1.795	-0.023 (0.042)	-0.548	-0.027 (0.104)	-0.260
Colour	0.635 (0.795)	0.799	0.258 (0.198)	1.303	0.011 (0.071)	0.155	0.030 (0.042)	0.714	-0.015 (0.102)	-0.147
Packaging	1.548 (0.805)	1.923	-0.067 (0.199)	-0.337	0.003 (0.072)	0.042	0.042 (0.043)	0.977	0.031 (0.103)	0.301
Flavour	1.960 (0.808)	2.426	-0.206 (0.200)	-1.03	-0.030 (0.071)	-0.423	0.023 (0.042)	0.548	0.005 (0.102)	0.049
Type	1.706 (0.797)	2.141	-0.046 (0.197)	-0.234	-0.059 (0.073)	-0.808	-0.002 (0.042)	-0.048	-0.040 (0.102)	-0.392
Taste	2.101 (0.804)	2.613	-0.169 (0.199)	-0.849	-0.116 (0.072)	-1.611	0.063 (0.042)	1.5	0.278 (0.102)	2.725
Fairtrade	1.477 (0.805)	1.835	0.076 (0.199)	0.382	0.058 (0.071)	0.817	-0.141 (0.043)	-3.279	-0.095 (0.104)	-0.913
Price	2.021 (0.827)	2.444	-0.306 (0.205)	-1.493	-0.019 (0.073)	-0.260	-0.014 (0.043)	-0.326	-0.015 (0.104)	-0.144

Source: Survey Data, 2015. n = 412 respondents.

Note (*) Pseudo *t*-test significant at 5%, within Bayesian inference, the coefficient's confidence interval excludes zero if the ratio of the estimate of the mean to the standard deviation exceeds 2.

6.3.5 Comparing between Attributes in terms of Attendance and Ranking

Table 6.6 presents a comparison between mean of stated non-attendance data and importance ranking data of the various attributes. The aim of this table is to show some expected consistency between stated AN-A and IR-A. First, in terms of stated AN-A, it can be seen from the table that the most attended attribute is olive oil flavour which has lower mean ignored (mean $_{\text{flavour}}$ = 0.107). However, respondents give less attention to the packaging attribute, which has higher mean ignored (mean $_{\text{packaging}}$ = 0.442). Results related to state AN-A can be considered realistic to a large extent because in most olive oil studies, flavour is more important than the packaging attribute. We have already considered that people ignored plastic packaging in glass for health and safety reasons. It is not as with wine, where it has been shown that the packaging attribute can affect consumer preferences positively or negatively. However, the flavour of olive oil as a quality indicator reduces with time compared with other attributes of olive oil.

Second, in terms of attributes importance ranking, scores start from number one for the most important and go all the way to number nine, which is the least important attribute, presented in the choice card. In this context, on table 6.6, results show that the respondents ranked flavour as the most important attribute (with lowest mean 4.218), followed by taste, price and type of

olive oil, ending with the package attribute as the least important attribute with mean (5.587). This makes the packaging attribute the most irrelevant attribute in terms of number reporting.

The outcomes for both (stated AN-A, IR-A) are realistic and consistent in regards to ordering data from most attended to least. For example, the flavour attribute has a lower mean ignored (i.e. most attended) which means the respondents will consider this attribute in their choice of preference and at the same time they will record the flavour attribute as highly important. In other words, the findings confirmed that highly ranked attribute were less ignored by respondents. This gives an indication that the respondents fully understand their choices, and those two specifications of AN-A and IR-A had strong correlation over respondents. The results show the higher mean attendance in perfect balance with better mean ranking data for a given attribute supported by Balcombe *et al.*, (2015).

Table 6.6: Comparing between Attributes Ordered in terms of Attendant and Ranking.

Attributes	Mean AN-A	Mean IR-A
Flavour	0.107	4.218
Taste	0.109	4.456
Price	0.117	4.515
Type	0.153	4.743
Organic	0.325	5.250
Fairtrade	0.330	5.784
Colour	0.359	5.260
CoO	0.364	5.434
Package	0.442	5.587

Source: Survey Data, 2015. n = 412 respondents.

6.3.6 Is High Price Associated with Higher Quality of Olive Oil?

This section investigates whether British consumers use the price of olive oil to judge the quality of olive oil. Respondents were asked to answer a 'dominated choice card' (always the seventh in the sequence) where the options had the same attributes levels except for the price attribute levels. The first price option was the level of £3.16. The second price option was the level of £2. The third price option was the level of £5.30. The last option was "I do not know" (See choice card seven in Appendix 4). The underlying construction of the CE assumes that it is rational for respondents to go for the cheapest option where all other attributes are the same. Findings in table 6.7 revealed that the majority of the British respondents, which account for 280 respondents, preferred to choose the cheapest price (£2 for 500ml). However, 18 respondents preferred the highest price £5.30, and 89 respondents choose £3.16 for 500ml.

The fact that many respondents did not go for the cheapest price means that there is some evidence that some consumers were using price as a quality cue. On the other hand, only a few respondents went for the highest price, perhaps meaning that respondents considered price as a cue of quality, but that choosing a middle price option was a viewed good balance between

quality and 'value'. The marketing literature has long considered price as a potential cue of quality (Verma *et al.*, 2004). However, from a pure CE perspective, this behaviour is viewed as 'irrational', since only non-price attributes are supposed to be the sole embodiment of 'quality'. The behaviour we have observed here may be symptomatic of a wider phenomenon within CEs that reflect the fact that no matter how wide the attribute set, respondents imagine there to be other attributes to the product that are not included within the CE. Thus, the attributes that are included not only have a direct signal in terms of the utility provide, but provide a cue about attributes that are perceived as "missing". The implications of using price as a quality cue means that the WTPs for the attributes within the experiment are inflated, and perhaps the relative WTPs are biased as well.

The fact that some respondents went for the higher price option does not necessarily establish that they were using price as a quality cue. It is possible that they were adopting a heuristic approach that went for "middle" options (or were simply making random choices). To shed further light on this issue, the responses to 'Card 7' need to be compared to other responses elicited from respondents. Therefore, the relationship between responses to the dominated card were evaluated in the light of responses from debriefing questions (attendance and ranking of attributes) but also from an open-ended question to respondents about whether they considered the price of olive oil is an indicator of quality.

Results obtained from an open – ended question revealed the number of respondents were classified into three groups. By taking these answers respondents were either have deemed to responded: i) in a way that indicated that they used the price as an indicator of quality; ii) a way that indicated that they did not use price as a quality cue; or, iii) a way that indicated neither.

Regarding to attendance (or stated non-attendance), results in table 6.7 revealed that respondents who ignored the price attribute is 49 respondents out of 412. On the other hand, the majority of respondents attend the price attribute 363 respondents. The relationship between respondents' preferences who attend (or ignore) price attribute and respondents' preferences who place their choices at different price levels (i.e. choice card 7); it was noted that the majority of respondents (363 person), who attend the price attribute, have a strong tendency to choose the cheapest price level £2. This indicates that respondents focus on their choices on a specific level of price attribute £2, and it might tend to ignore other levels. The implication provides in this case insights into how respondents place the quality feature in their choices based on a price level (i.e. £2). Respondents may not believe that the high price indicates a higher quality, therefore respondents' choice is consistent and ideal in choice set seven, *ceteris paribus*

assumes no other attributes change. This finding could support the belief that consumers are not consider the higher price the better quality in a variety of quality features of olive oil.

On the other side, it was consistent in our DCE that the minority of respondents (49 respondents) revealed that the price is being ignored. Because ignoring price attribute in CE, it may result a problem for the computation of WTP, respondents do not make any trade-off required for WTP estimation. Sometimes the reason beyond stated AN-A for the price attribute might be that the price has a limit range in consumers'' mind for buying process. Rose *et at.*, (2005) noted that when a specific attribute is being ignored, then the marginal utility of WTP is zero for that attribute, and when the price attribute is being ignored then WTP come to be infinite. Accounting for AN-A leads to significantly lower WTP estimate (Balcombe *et al.*, 2011; Scarpa *et al.*, 2009; Campbell *et al.*, 2008) or maybe higher WTP estimation (Hensher *et al.*, 2005a; Hensher and Green, 2010).

In terms of importance ranking for the price attribute, results revealed the number of respondents who gave a number one for highest importance price ranking and a number nine for the lowest importance and its percentage. Respondents who rank price attribute as a first/second/third important are account for 189, and 64 respondents (16%) who gave the price the lowest importance ranking. The relationship between respondents' preferences who ranking price attribute and respondents' preferences who place their choices at different price levels (i.e. choice card 7) was noted that respondents who gave a lower importance ranking to the price attribute have a strong tendency to choose the cheapest dominant price level (£2). This implies a consistency in the respondents' behaviour. However, the inconsistent results are apparent when respondents consider the price at the highest important ranking, and placed their choices to the cheapest dominant price level (£2). This indicates that the degree of association between ranking price attribute and respondents' choices and preferences are not strong enough. People may employ different response heuristics when they made their decision or they might state differently to what they actually behave. This implies how the price attribute affect consumers' behaviour at final decision.

Form these results; it can be noted clearly that there is a strong tendency for the majority of the people who attend the price attribute to choose the cheapest dominant option. In addition, the respondents who gave lowest rank for the price might choose the cheapest olive oil price. Therefore, people in terms of attendance and lowest ranking price attribute are consistent with their choices and preferences in choice experiment.

From the market perspectives, it can be noted that consumers pounce on lower prices of the products without hesitation, while others are not. Most people simultaneously believe that low price means good quality, as well as that low price means low quality, if consumers do not have enough information about the product in the market (e.g. a new product in the marketplace such as Syrian organic olive oil in our study). On the other hand, consumers have doubts about the quality of the product, therefore, consumers will assume that a high price is not necessarily an indicator of high quality and they will choose the cheapest price of the product. However, more expensive price does not always mean better quality. Whatever is going on in consumer's heads can influence how they perceive a price, and whether or not they decide to purchase the product. In non-traditional olive oil markets, such as the UK, where consumers are less familiar with olive oil products due to lower frequency of purchases, some consumers have learned to use heuristics in their buying decision (to not attend); they might be not want to pay more for this product, and they will go to the cheapest price.

Conversely, some respondents often evaluate the quality of olive oil based on a variety of intrinsic attributes, which they associate with the product such as taste and flavour, or based on extrinsic attributes such as price, packaging and so on. From the consumer's perspectives, price is one of the most important attributes to evaluate the quality of olive oil products. If consumers have experience consuming olive oil products; then, they will consider the olive oil quality the most important thing in their mind. Therefore, their belief that high price is an indicator of higher quality will guide their decision making and they will pay more. This might be considered as a rational behaviour for some consumers who have more experience than others do. In addition, the price of olive oil products could provide consumers with additional information about the product quality *per se* such as organic, CoO, production cost. Therefore, respondents will get what they paid for; for this reason, they will believe that the higher the price, the better the quality. In some cases, the individuals' income can play a role in judging the quality of olive oil according to the price, as everyone has a ceiling and floor limit on prices when making a purchase decision. A rational behaviour by the consumer is not pay extra money to get a product without having a greater satisfaction, while it is still common for some consumers to use the price for judging the quality of the product. There are some similarities between part of our findings and the approach proposed by Olson (1977); he has suggested that respondents are more likely to use price as a cue of quality for relatively expensive products.

Previous studies have shown that the relationship between the price and quality is still unclear. (Curry, 1985; Gerstner, 1985; Riesz, 1978; Sproles, 1977) pointed out that there is no evidence about a strong relationship between the objective quality and price of the product. Recently,

researchers have made an effort to identify the conditions which make consumers use price to infer the quality of the product. One of these conditions is the absence of other information cues provided to respondents; therefore, a consumer is more likely to use the price as a quality cue. However, Bakeron (2011) provided results from a panel of three olive oil experts who sampled 12 different EVOO from very famous brands of olive oil (like Napolina and Filippo Berio) against supermarket brand names (like Tesco, Waitrose, M&S) with different prices for each bottle. Results of a taste test of olive oil by British based product-testing magazine "Which?" suggested that consumers may not essentially need to select the most expensive bottle when searching for high quality olive oil. Bakeron's Findings concur with ours.

Overall, the conclusion is therefore that some respondents do not recognise that they use price as a cue of quality, or they have adopted some other form of heuristic the nature of which is unclear.

Table 6.7: Is High Price Associated with Higher Quality

Choice Card 7	Option 1 (£3.16)	Option 2 (£2)	Option3 (£5.30)	I Do Not Know
Answer	89	280	18	25
Open – Ended Question	Yes	No	No Answer	
Answer	107	188	117	
Number of Respondents Who Ignore Price Attribute			49	
Number of Respondents Who Attend Price Attribute			363	
Ranking Price Attribute [51]	Number of Respondents		Percentage	
1	94		23	
2	51		13	
3	44		11	
4	33		8	
5	33		8	
6	35		9	
7	24		6	
8	30		7	
9	64		16	

Source: Survey Data, 2015. *n* = 412 respondents.

[51] Number one represents highest importance ranking for the price attribute and number nine represents the lowest importance

6.4 Estimation Results of Mixed Logit Model & Interpretation of Willingness to Pay

Different model specifications have been examined using The GAUSS 11.0 Software; model specifications have been estimated with a total of 412 observations, (the total of our sample was 414 but two observations were incomplete in the online survey). All model codes have been written by Professor Kelvin Balcombe using a Bayesian approach and all the diagnostics exist in the Gaussian code. MCMC technique was used to achieve the convergence[52] of the model by setting the burn-in phase to 500 iterations as a prior to starting the convergence (so-called pre-convergence step). Then after achieving the convergence points, every 100th draw "skip" was kept from 1,000,000 iterations to leave the values of the posterior distribution within 10,000 draws from the posterior sampler (this is so-called post-convergence step). Markov Chain has actually observed to achieve the convergence in both visual and statistical tests. The visual test gives the plots of the values that have run and moved around the parameter space to give the sequences of **Alpha (α)** which is the mean of the latent variable β. **Omega (Ω)** is the mean of the variances. In addition, **Lambda (λ)** which is the threshold parameters (the so-called cut points) and **Sigma (σ)** is the variance of Gumbel error term and the scale parameter of heterogeneity. Whereas there is other technique to weigh convergence, as the assessment of autocorrelations coefficients, this assessment was used to examine the degree of dependence for the sampled values in our chain. Usually every 100th draw of "skip" iteration was reserved in terms of reducing the degree of dependency of values with achieving a high level of autocorrelations. The statistical test of convergence is through modified *t*-test for the hypothesis of "no-difference" between the first and the second halves of the sampled valued for each value of the parameters.

[52] According to Lancaster (2004), the convergence of the model means whether (or not) the state distribution (*Pt*) will get arbitrarily close to the unique stationary (target) distribution (*P*) when that exists. Designing the convergence in MCMC sampling, not only means that the chain has the target distribution as its stationary distribution, but also that the chain should show the state distribution would converge to the target. Roughly speaking, the convergence of the model can be achieved by adding another condition on the MCMC chain.
From Markov Chains Theory, our expectations are that MCMC test to converge for the stationary distribution, which is our target distribution as well. However, there is generally no guarantee of how many draws should be needed to get the convergence in MCMC. In literature, according to Koop (2003), achieving the model convergence by using the standard diagnostics are monitored in three ways; visually by using the traceplots (the plot of the values against the value of the draw of the parameter at each iteration) or traceplots and density plots or running mean plots. The second way of assessing the convergence is via the autocorrelations between all the draws in MC. The third way is the modified *t*-tests.

All data sets were generated by the choice experiment techniques and we included supplementary questions for AN-A and IR-A (See Appendix 4). Results recorded in this section represent three attractive model specifications with fixed and/or random coefficients[53] with different distributions for the parameters. All attributes' parameters are distributed normal[54] (including Status Quo) except that the price attribute parameter is distributed lognormal. Moreover, the assumption through the utility function is that the utility coefficients vary among respondents and constant the choice situation at an individual level. This in its turn can assure the underlying notion of the structure of stable preference for all respondents.

Model specifications have been estimated employing Mixed Logit model (ML) as follows:

1- Attribute Fully Attend (AF-A): respondents consider all attributes in DCE, and there is no restriction on the parameters.
2- Attribute Non-Attendance (AN-A): respondents asked a debriefing question which is Yes /No type to AN-A for each attribute. In this specification, shrinkage parameter (ρ) is imposed in the model specification of AN-A. Model performance is best when the shrinkage parameter is as small as possible with decreasing marginal utility for smaller and smaller (ρ). (See chapter four, section 4.4.3.3)
3- Importance of Ranking Attribute (IR-A) respondents asked a debriefing question to rank the importance of attributes. In this specification, ranking information was included in mixed logit model to help explain choice results. (See chapter four, section 4.4.3.4).

All results recorded from previous specifications discuss in terms of three different scenarios:

1- First scenario: The marginal utility has been unconditional on existing SQ option.
2- Second scenario: The marginal utility has been conditional on existing SQ option.

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[53] Considering the cost payment attribute is distributed as a random coefficient; this; can affect WTP estimation into two different perspectives. First, Scarpa *et al.*, (2008) explained how random cost coefficient makes the marginal WTP to be volatile (i.e. WTP = Attribute's coefficient/ Price (Cost) coefficient). An effective assumption to cope with inconstant volatile problem is achieved by assuming the random cost coefficient to be fixed coefficient /Not random (e.g., Revelt and Train (1998); Goett *et al* (2000)). In this respect, it is useful to imply a specific distribution for cost payment coefficient (e.g. lognormal distribution for price attribute) which gives restriction to cost coefficient to be close to zero. As a result, WTP values will be a large and stable. Second, Ruud (1996) found that the simulated moment method of WTP was determined by the computational tractability and he tried to develop a new estimation strategy by identifying the variance matrix parameters to handle WTP ratio.

[54] Estimating all models for lognormal distributions for all attributes coefficients are pointless and not fit a model performance especially in the matter of the model convergence; this point supported by Balcombe *et at.*, (2009).

3- Third scenario: The marginal utility has been conditional on existing SQ option and conditional on demographic characteristics (Age, Gender, Size of household, and Income). (See chapter four, section 4.4.3.2)

6.4.1 Model Comparison Approach

Several different models were included in this research and may all seem reasonable given the data, but this led nevertheless to different conclusions about our questions of interest. In this situation, selecting a best model performing and basing inferences on it will help in discriminating between models and getting a good interpretation for best model results. A model comparison intends to choose a robust parsimonious[55] statistical model in order to recognize variables that have the strongest impact on outcomes. The models were estimated in Bayesian procedure. Bayesian MCMC approach help providing an appropriate framework for model comparison through computing Marginal Log Likelihood (MargLL) (Balcombe *et al.*, (2009) & Balcombe *et al.*, (2010)).

To get MargLL and choose the best performance model, calculation is completed by applying the equation 4.28. The superior support model is selected with a large value of (MargLL) which is the smallest value in terms of negative sign. Table 6.8a (horizontally for each row) shows the calculation of MargLL for three specification models (AF-A, AN-A and IR-A) with different three scenarios (without SQ, with SQ, with SQ & Demographics characteristics).

In terms of excluding SQ from our estimations (horizontally for each row), it can be seen that AN-A model is the superior model and is preferred to IR-A then AF-A model is in the third position. In terms of including SQ, AN-A is the preferred model then IR-A, and finally, in the third position AF-A. Finally, in terms of including SQ & Demographics characteristics, IR-A is the first superior model and is preferred to AN-A, and the fully attendant attributes model is the inferior one in this scenario.

As a result, table 6.8a presents that the selection of the robust parsimonious statistical model is the second scenario, where the marginal utility has been conditional on existing SQ option. AN-A is the superior model and is preferred to IR-A then AF-A. This finding is significant in terms of confirming that AN-A model is valuable competing importance ranking model. According to the model fit, imposing shrinkage parameter in model specifications, as mentioned earlier, gives the highest MargLL for the superior model among others (i.e. $MargLL_{AN\text{-}A} = -3204.02$).

[55] Parsimonious model means the simplest plausible model with the fewest possible number of variables. It can explain a lot with very little.

Table 6.8a: Marginal Log Likelihoods (horizontally for each row: one is most preferred and three is less preferred)

MargLL	**AF-A / Specification 1**		**AN-A / Specification 2**		**IR-A / Specification 3**	
Without SQ	-3256.4651	**3**	-3226.6367	**1**	-3229.9603	**2**
With SQ	-3232.5665	**3**	-3204.0268	**1**	-3211.1529	**2**
With SQ & Demographics	-3434.8750	**3**	-3396.8454	**2**	-3391.5432	**1**

Source: Survey Data, 2015.

Fifteen were the variables used in analyzing the data set, representing nine attributes (Organic, Country of Origin (CoO), Colour, Taste, Flavour, Package, Type of olive oil, Price and Fairtrade) with different levels for each attribute. The following table 6.8b consists of attributes coding variables from *x1* to *x15* and the base level for dummy coding.

Table 6.8b: "X" Is A Vector of Observed Variables Relating to All Other Alternatives.

Variable	**Attributes & their levels**	**Variable**	**Attributes & their levels**	**Variable**	**Attributes & their levels**
X1	Price	***X6***	Dark Green (Green)*	***X11***	Light (Extra Virgin) *
X2	Organic (Non-Organic) *	***X7***	Yellow (Green)*	***X12***	Standard (Extra Virgin) *
X3	Italian (Syrian)*	***X8***	Plastic (Glass)*	***X13***	Smooth (Strong)*
X4	Spanish (Syrian)*	***X9***	Nutty (Fruity)*	***X14***	Fairtrade (Not Fairtrade) *
X5	Greek (Syrian)*	***X10***	Bitter (Fruity)*	***X15***	Stats Quo (If included in the model) *

The Symbol (*) point out that the attribute level in parentheses are the base level for dummy coding.

6.4.2 Parameter Estimates of Mixed Logit Model

In this part, results of robust parsimonious model will be explained including a standard choice model in table 6.9 in terms of including SQ, where the AN-A is the superior model and is preferred to IR-A then AF-A. Then, WTP estimation is explained in table (6.10).

6.4.3 A Standard Choice Model with SQ

Table 6.9 presents results of a standard mixed logit including a status quo for each specification (i.e. Attribute Fully- Attendance (AF-A); Attribute Non-Attendance (AN-A); and Importance Ranking-Attributes (IR-A)). For each specification, results report transformed coefficients of mean of (α) which means the mean of latent variable β and standard deviation of (α) which means the standard deviation of latent variable β. In addition, results in the table include mean of posterior which is also called mean of variance of the utility coefficients (it is the diagonal component of variance covariance matrix Ω). The table also includes standard deviation of variance of the utility coefficients; both mean and standard deviation of variance of estimation

draws provide summary information about the posterior. The ratio of the mean of α to standard deviation of α gives the "Pseudo *t*-statistic". At the bottom part of table 6.9, results record the mean and standard deviation of coefficient rho (ρ) which represents the distribution of shrinkage for AN-A and IR-A.

Table 6.9: A Standard Choice Model of Transformed Coefficients

Variable	AF-A					AN-A					IR-A				
	Mean of α	St Dev of α	Mean of Variance	St Dev of Variance	Pseudo t-Statistic *	Mean of α	St Dev of α	Mean of Variance	St Dev of Variance	Pseudo t-Statistic	Mean of α	St Dev of α	Mean of Variance	St Dev of Variance	Pseudo t-Statistic
Price	1.939	4.879	2.122	0.289	0.397	1.924	4.680	2.000	0.272	0.411	1.806	4.397	1.948	0.275	0.411
Organic	0.348	0.733	0.535	0.210	0.476	0.491	0.719	0.670	0.263	0.683	0.313	0.621	0.689	0.267	0.504
Italian	0.638	0.852	0.722	0.396	0.748	0.640	0.806	0.846	0.432	0.793	0.484	0.728	0.958	0.592	0.665
Spanish	0.291	0.754	0.566	0.226	0.385	0.401	0.769	0.827	0.388	0.522	0.288	0.672	0.834	0.350	0.429
Greek	0.458	0.658	0.433	0.177	0.696	0.484	0.764	0.792	0.329	0.633	0.447	0.576	0.591	0.317	0.776
Dark Green	0.134	0.487	0.237	0.101	0.276	-0.010	0.488	0.353	0.179	-0.021	0.140	0.417	0.316	0.170	0.335
Yellow	0.044	0.609	0.370	0.179	0.073	-0.160	0.635	0.596	0.268	-0.253	0.022	0.529	0.518	0.259	0.042
Plastic	-0.275	0.617	0.380	0.145	-0.446	-0.355	0.637	0.625	0.241	-0.557	-0.189	0.489	0.458	0.203	-0.387
Nutty	-0.161	0.612	0.372	0.156	-0.263	-0.160	0.683	0.512	0.209	-0.235	-0.201	0.623	0.595	0.267	-0.323
Bitter	-1.288	1.013	1.020	0.352	-1.272	-1.348	1.162	1.385	0.425	-1.160	-1.316	1.082	1.703	0.584	-1.217
Light	-0.868	0.674	0.452	0.192	-1.288	-1.023	0.819	0.681	0.301	-1.249	-0.934	0.693	0.748	0.318	-1.349
Standard	-1.005	0.815	0.660	0.240	-1.233	-1.084	0.918	0.877	0.340	-1.181	-1.031	0.842	1.121	0.412	-1.225
Smooth	0.388	0.487	0.236	0.103	0.797	0.312	0.518	0.292	0.126	0.603	0.379	0.452	0.314	0.159	0.838
Fairtrade	0.032	0.779	0.610	0.211	0.041	0.276	0.783	0.847	0.294	0.353	0.073	0.691	0.940	0.341	0.106
SQ	-0.066	1.161	1.338	0.475	-0.057	0.037	1.194	1.416	0.424	0.031	-0.029	0.992	4.262	1.738	-0.029
● Shrinkage Coefficient (ρ)						Mean	St Dev				Mean	St Dev			
						0.312	0.059				0.585	0.068			

Source: Survey Data, 2015. n = 412 respondents.

-Note (*) Pseudo *t*-test significant at 5%, within Bayesian inference, the coefficient's confidence interval excludes zero if the ration of the estimate of the mean to the standard deviation exceeds 2.

-The 95% Bayesian credibility interval is approximately equal to mean posterior ±1.96. s $/\sqrt{n}$

- (●) Shrinkage Coefficient is explained in details in chapter four: Mixed logit model specification

First, for the normally distributed coefficients, the estimated mean of (α) and St Dev of (α) of latent variable β provide information on the share of the population which states a positive value on the attribute as well as a negative value on some other attributes due to the heterogeneity of the respondents. The attribute parameters for each specification are, to some extent, consistent because the change in model specifications should not impact on the sign of the parameter estimates. In our table, it can be seen that the mean of (α) for AF-A and IR-A has negative signs for plastic (i.e. Package), nutty and bitter (i.e. Flavour); light and standard (i.e. Type of olive oil) and SQ. This indicates that respondents have less marginal utility for those attributes than their counterparts, those attributes might be not preferable at that level of attribute due to health issue (i.e. Plastic) and its impact on the quality of olive oil. The same findings have been published in 2009 by (Guil-Guerrero, 2009) and support ours. They found that different packaging of olive oil bottle (i.e. dark glass, transparent glass… etc) affect the quality of extra virgin olive oil. EVOOs stored in transparent glass bottle reduced significantly with respect to other kind of packaging, thus, consumers prefer the glass container in terms of health and safety. Del Nobile *et al.,* (2003) mentioned in their article comparing two kinds of packaging, neither plastic nor glass will affect the quality of virgin olive oil. Generally, consumers prefer a glass container rather than a plastic one due to marketing aspects in regards to some chemical facts proving that the glass container is environmentally better. Martínez *et al.,* (2002) proved that the packaging attribute is the least-valued attribute for British consumers.

Similarly, respondents do not prefer nutty or bitter flavour (i.e. Mouthfeel). Respondents might consider a bitter flavour as an unpleasant sensory characteristic of olive oil, which changes the taste of olive oil in the mouth, thus, they try to avoid it in their choice. Moreover, flavoured olive oil would not be suitable and fit all kinds of everyday cooking or dressing salad. Unlike our findings, Cicia *et al.,* (2013) found in their empirical study that respondents increase the value of bitter flavour of olive oil as well as fruity and pungent flavour, whereas, less value has been given to a sweeter flavour of olive oil.

Another attribute that has negative sign of utility is the type (Grade) of olive oil. People have concerns about which type of olive oil should be consumed, and they have less utility for light and standard olive oil relative to extra virgin olive oil (i.e. For AF-A; mean $(\alpha)_{light} = -0.87$, mean $(\alpha)_{standard} = -1.01$) and (For IR-A; mean $(\alpha)_{light} = -0.93$, mean $(\alpha)_{standard} = -1.03$). This finding is strongly compatible with our expectations where most of UK population will strongly take into consideration food quality and safety, and are beginning to recognize different grades of olive oil. However, Martínez *et al.,* (2002) considered that British people prefer a standard expensive olive oil more than extra virgin because of the lack of consumer understanding with

regards to grade of olive oil, they consider that standard olive oil is the same of extra virgin olive oil in terms of health benefits. In contrast, Chan-Halbrendt *et al.,* (2010) found that respondents preferred to choose extra virgin olive oil over other types of olive oil and they were willing to pay more for this attribute even in the case of people who belonged to lower income households.

However, for AN-A model, mean of (α) is not only negative for package and flavour and type, but also for dark green and yellow level of attribute (i.e. colour of olive oil). Ignoring specific colour of olive oil (i.e. yellow or dark green) might be because of respondents' habits of repeatedly buying the same product with the same colour every time. Alternatively, they do not have enough information about the meaningful definition of the different colours of olive oil. Sometimes, the bottle of olive oil has an opaque glass and the real colour of olive oil will be hidden. Gámbaro *et al.,* (2014) found that consumers, in non-traditional, emerging olive – growing countries, do not have a clear picture about their preferences of olive oil colour. Respondents clearly reject a yellow colour of olive oil and consider that yellow colour is a sign of a poor-quality oil because it has the same colour as seed oils such as sunflower, corn, soybean and rice oils. Respondents prefer to select a distinct greenish colour of olive oil. Also, US study by (Recchia *et al.,* 2012) found evidence that consumers dislike the deep green colour of olive oil.

Turning to attributes which have positive signs of utility, in terms of AF-A and IR-A, it can be observed from the same table that organic, country of origin, colour, taste and fairtrade have positive signs and are statistically significant. This indicates that, for example, the preference for organic olive oil has been associated with many reasons that reveal an increased interest to personal health, and environmental protection. Our results here are almost aligned with the findings of (Magkos *et al*., 2006).

Not surprisingly, Italian olive oil is preferred strongly by UK population and it carried the most positive and highest coefficient relative to the other level of country of origin attribute (e.g. mean $(\alpha)_{\text{Italian}} = 0.64$), it might be in the face of high consumer expectations. Alternatively, it could be relevant to health on positive virtues of the Mediterranean diet and the level of acidity, which has recently been considered as indicator of quality and safety in the eyes of the consumers. Our findings related to country of origin are in similar sense to Finardi *et al*., (2009). In addition, Dekhili *et al*., (2011) investigated different quality cues of olive oil products, and they found that the country of origin and region of origin are considered important for consumers in their decision- making in selecting a product. Schnettler *et al.,* (2008) pointed out

that the importance of the country of origin in the purchase decision is greater than the extrinsic cues such as price and packaging.

The sign for olive oil colour is positive and significant for people who attend all attributes and for respondents who consider the colour important. This indicates that product colour (i.e. yellow or dark green relative to green one) is considered attractive to influence consumer choice, despite the fact that colour of olive oil is not considered among the classification criteria used to define the grades of quality of olive oil. In fact, two pigments content, which are chlorophylls and carotenes, give different colours to olive oil. In addition, time of harvesting the olive fruits and extracting the oil play a crucial role in giving a variety of colours. It seems that some respondents, who are not used to using olive oil regularly in their everyday cooking, will consider that all colours have the same value. Choosing a specific colour such as yellow might be related to other factors like price, brand name, and so on. Unlike our findings, Moyano *et al.,* (2010) found that respondents reject olive oil in terms of its colour even though the other sensory attributes seem to be suitable. In contrast to AN-A where yellow and dark green olive oil are negative signs as mentioned earlier.

Some respondents who prefer the smooth taste of olive oil relative to a strong taste. The reason behind selecting a smooth taste is ambiguous; it is difficult to treat this attribute due to its sensory properties and we did not do a sensory assessment for this attribute in our choice experiment. From the few studies conducted in the UK market with regard to olive oil products, McEwan (1994) investigated consumer awareness and attitudes towards olive oil, and he found that the relationship between olive oil acceptability and different cues of olive oil within different groups of samples was significant.

This is a positive and significant sing for the fairtrade olive oil attribute. It might be because UK respondents prefer fairtrade olive oil and have a tendency to give more value to this attribute. It might be a form of support to the country, which has had a difficult time, like Syria or their willingness to help farmers to improve lives in some impoverished areas. These results are more consistent with a survey conducted in the United States by Loureiro and Lotade (2005), in which they found that respondents were very receptive to fairtrade coffee label and have a willingness to pay ($0.22) more for it.

However, SQ has a positive value and is statistically significant for AN-A (i.e. Mean $(\alpha)_{SQ}$= 0.037), this indicates that respondents have a propensity to choose SQ despite ignoring some attributes in their choices. Respondents might face a very difficult and complex choice card and they try to simplify their choice by giving more utility to SQ option. Another explanation is that

it might be in accordance with *a priori* expectation of its attributes, the utility decreases for AF-A and IR-A with a negative sign for both. Meyerhoff and Liebe (2006) discussed three main determinants (i.e. protest belief, attitude toward the environmental change and task complexity) of existing SQ in CE and its impact on respondent decision making, and they found that the likelihood of a chosen SQ increased with the complexity of the task and stronger protest belief, while decreased with the attitude.

As highlighted before, the distribution of the price attribute is lognormal to assure that it has a positive sign for all respondents, and to avoid some issues regarding a normal distributed price coefficient. As can be seen from table 6.9 results reveal that the probability of price attribute is slightly higher than its counterparts of olive oil attributes. This might indicate that consumers consider the price as a main factor in their buying decision of olive oil. Alternatively, it could be that individuals prefer to choose a better quality of olive oil based on the high price of product. Unlike previous studies that pointed out that the price attribute is the most ignored attributes, respondents seem to prefer better a quality of product irrespective of the price attribute. For the price coefficient, in some cases, the estimation produces a negative price coefficient, which indicates lower utility from higher olive oil prices. The sign of the coefficient is consistent with *a priori expectations* as we usually expect that individuals will prefer lower prices. Ribeiro and Santos (2004) connected the price of olive oil to some attributes such as the acidity level, production method (organic) and olive territory origin. However, Karipidis *et al*., (2005) connected the price attribute to the information on the label, the packaging and to different supply chains. Martínez *et al.*, (2002) found that the price of standard olive oil is the most significant attribute influencing consumers' preferences rather than the size of the container or the packaging attribute; the size of the container can affect consumer choice by selecting the smaller packs rather than the larger ones. The packaging attribute, either glass or plastic, is the least significant preference for consumers' in Britain.

In terms of considering the mean and St Dev of posteriors (or variance) for all attributes in our results, as can be observed in the table, the coefficients are strongly consistent. This in turn gives more support and strong evidence that on a 95% Bayesian credibility interval of the estimated mean and standard deviation of the transformed coefficients across three specifications are significant[56] and consistent.

At the bottom of the table, results record the shrinkage coefficient for AN-A with average equal 0.312. The coefficient is statistically significant and robust because its value is relatively close

[56] 95 % Bayesian credibility interval is approximately equal to mean posterior ±1.96. s /√ n.

to zero. This suggests that respondents who are non-attenders have on average 31% of the marginal utility of attenders and lowest ranking. In addition, this indicates that the AN-A data has had a significant impact on model performance, and it causes a reduction of marginal utility. With respect to the model fit, the shrinkage parameter achieved the highest MargLL in terms of AN-A. It clearly seems from the table that the reduction of the marginal utility compromised all attributes for all specifications.

It can also be noted from the table that the shrinkage coefficient rho (ρ) for IR-A is on average equal 0.585; the coefficient is statistically significant and indicates that the IR-A data has a significantly good impact on the model outcomes. The coefficient on its value is close to one, this indicates that the attribute with lowest ranking will have zero marginal utility and less attend (i.e. package attribute in IR-A specification). Table 6.8a can prove how the distribution of shrinkage improved the model performance and impacted on AN-A and IR-A. The shrinkage approach has been used by (Balcombe *et al.*, 2015) and (Hess and Hensher, 2013).

For both specifications, AN-A and IR-A, on average, respondents who ignored some attributes in their choices have their marginal utility shrunk by 31.2% while respondents who gave importance for their ranking data have their marginal utility shrunk by 58.5%. The magnitude of shrinkage coefficients in this study is between 0.312 to 0.585, whereas previous studies such as Kehlbacher *et al.,* (2013) found that the shrinkage coefficients range were from 0.079 to 0.282 for two choice experiments. Scarpa *et al.,* (2009) found that the shrinkage parameter for the cost attribute is 0.168 while the range for other attributes was form 0.632 to 0.896. Hess and Hensher (2013) used attribute-specific shrinkage factors to estimate the marginal utility parameters in terms of importance rating attributes. They found that the range of the shrinkage coefficients was from 0.0921 to 0.315 for attributes used in the experiment while for the two cost attributes were 0.391 and 0.768.

6.4.4 Willingness to Pay Estimation

The marginal rate of substitution among attributes can be calculated as a ratio of the coefficients. Marginal utility of WTP can be estimated by dividing the coefficient of any attribute to the coefficient of the price attribute. In this section, table 6.10 presents the median, upper and lower quartiles on 95% and 5% respectively for respondents WTPs for three specifications (AF-A, AN-A, IR-A). We used choice experiment data on olive oil attributes to investigate what is the impact of different specification on WTPs estimates and how SQ affect the model in terms of AF-A, AN-A and IR-A. Practically, median WTPs are calculated using the ratios of the distribution of latent coefficients attributes divided by the distribution of the

monetary attribute (i.e. price has log normal distribution). We choose to focus on median WTP to report because the mean of WTP is unstable for both preference space and WTP space (Balcombe *et al.*, 2009; Balcombe *et al.*, 2015) and it is presented as a ratio of two random variables, thus the variance according to that will be infinite.

Table 6.10: WTP Estimate (Median, Upper and Lower)

Variable	AF-A			AN-A			IR-A		
	Median	Lower 5%	Upper 95%	Median	Lower 5%	Upper 95%	Median	Lower 5%	Upper 95%
Price	1	1	1	1	1	1	1	1	1
Organic	0.305	-0.084	1.796	0.394	0.022	1.805	0.299	-0.042	1.721
Italian	0.474	0.061	1.299	0.447	0.095	1.328	0.355	0.009	1.173
Spanish	0.234	-0.15	1.522	0.277	-0.027	1.424	0.243	-0.091	1.473
Greek	0.389	0.009	1.579	0.323	0.014	1.323	0.388	0.039	1.448
Dark Green	0.096	-0.162	0.833	-0.005	-0.248	0.439	0.104	-0.112	0.707
Yellow	0.034	-0.228	1.135	-0.073	-0.405	0.414	0.016	-0.229	0.805
Plastic	-0.198	-1.034	0.129	-0.208	-0.863	0.013	-0.136	-0.795	0.117
Nutty	-0.103	-0.777	0.287	-0.093	-0.775	0.322	-0.138	-0.892	0.224
Bitter	-1.255	-3.24	-0.424	-1.235	-3.294	-0.389	-1.298	-3.291	-0.437
Light	-0.886	-2.454	-0.268	-0.964	-2.553	-0.324	-0.982	-2.599	-0.334
Standard	-0.971	-2.511	-0.315	-0.974	-2.536	-0.329	-1.022	-2.648	-0.342
Smooth	0.345	0.032	1.29	0.253	-0.013	1.201	0.342	0.05	1.144
Fairtrade	0.021	-0.361	1.202	0.193	-0.101	1.472	0.049	-0.274	1.101
SQ	-0.038	-1.338	0.72	0.02	-1.352	0.767	-0.017	-1.187	0.620

Source: Survey Data, 2015. n = 412 respondents.

In the median WTP estimation, the estimation for the willingness to pay a price premium by British respondents seems generally consistent and reasonable with their preferences, as mentioned earlier in table 6.9. First, For AN-A specification, it can be observed that respondents have positive and significant signs for attributes (i.e. Organic, CoO, taste, fairtrade and SQ) while they have a negative utility toward colour of olive oil, package, type, and flavour of olive oil. It reveals that UK consumers are willing to pay a price premium for organic olive oil around 39 pence ($WTP_{organic}$= 0.394) rather than for non-organic olive oil. as mentioned in literature review, Duquenne and Vlontzos (2012) studied the relationship between socio-economics categories (e.g. age, education level, household's size, income, etc) and consumers' preferences of olive oil attributes such as price, packaging and environmental protection. They found that age and education levels are the most influential factors affecting the purchasing behaviour of Greek consumers. Household size and family income were not significant in influencing consumers' purchases. 66.4% of consumers were also willing to pay a price premium for organic olive oil, while 30.9% of consumers were willing to pay more for certification protocol.

From our results, it is expected that respondents who are more concerned about health and safety will be more likely to pay a premium for a healthier food choice. This implies increasing the demand on organic olive oil in the UK market based on the changing food habits toward healthier and safer products. This finding could provide a justification for Syrian farmers promoting organic agriculture abandoning the conventional methods for planting olive trees. It will also help Syrian marketers to go through the regulation process and labelling program by providing an organic certification and labelling. It will also help to find exporting business opportunities to access an international non-traditional market in the UK.

The magnitude of WTP for Italian olive oil is around 45 pence more relative to Syrian olive oil ($WTP_{Italian} = 0.447$). This implies that British respondents are not willing to pay a premium for Syrian olive oil when compared to other countries. This finding decreases the potential for marketing Syrian olive oil in the UK, because consumers are already familiar with Italian olive oil. However, there is still a chance for Syrian olive oil to access to UK market. If the UK market determines the price premium of Syrian organic olive oil as equal as or less than the Italian oil, then the opportunity for Syrian oils product to access the British market will be possible to large extent. In other words, if the UK market provides consumers with organic Syrian olive oil cheaper than Italian, then *ceteris paribus*, then it would be possible for Syrian organic olive oil to access in the UK market. It is clearly in the line with findings by Del Giudice *et al.,* (2015); Panico *et al*., (2014) and Lombardi *et al*., (2017).

The signs for some attributes are negative. The negative sign attached to the nutty or bitter flavours relative to a fruity flavour of olive oil (i.e. $WTP_{nutty} = - 0.093$ and $WTP_{bitter} = -1.24$) implies that UK respondents are not willing to pay more for these attributes. For the type of olive oil, British respondents are willing to pay higher premium for extra virgin olive oil than light or standard type. It is consistent with the consumers' preferences mentioned earlier. AN-A model is considered important with regard to its impact on WTP estimates. It is clear from the table that there are significant differences between AN-A model and other models in terms of WTP values. A little impact from accounting AN-A on WTP for colour of olive oil make respondents not prepare to pay more for this attribute.

In terms of AF-A and IR-A models, it is striking noticed that British respondents are willing to pay more for the same attributes. The most noticeable difference between these two models and AN-A results is in WTP for colour of olive oil. For instance, people are prepared to pay a very small premium for dark green or yellow colour of olive oil relative to green colour. While a negative WTP for colour attribute for AN-A was found in the results.

It can be seen from table 6.10 that all respondents have negative median WTPs for SQ alternative in terms of attendance all attributes in choice task (i.e. $WTP_{SQ/\ AF\text{-}A}$= - 0.038), and for Importance ranking attributes as well ($WTP_{SQ/\ IR\text{-}A}$= - 0.017). However, median WTPs are positive for AN-A (i.e. $WTP_{SQ/\ AN\text{-}A}$= 0.2) and it is the most appropriate when the SQ alternative is included in the choice task. We cannot ascertain that there is a relationship between the AN-A and SQ in this study due to the simplified choice by using heuristics to make SQ choice or to simplify the complexity of the choice task. It might also be to avoid some irrelevant attributes or some other reasons stated in our literature review. Thus, our indication for the positive relationship between AN-A and SQ is that the individuals are able to assess the SQ alternative in terms of their utility and are willing to pay more for this option.

Further, results reveal that all individuals have negative WTPs for packaging, flavour and type of olive oil respectively for AF-A and IR-A. However, it is more striking to notice that respondents are more likely to rely on simple heuristics to make their decision by ignoring some attributes, and this can be clearly observed in the negative WTPs for more attribute presented in the choice sets. For instance, for individuals who do not consider all attributes, median WTPs decreased for dark green and yellow colour of olive oil. The reason behind using heuristics might be that less information is provided to respondents in the choice task or that people make their decisions based on time limitation or limited cognitive resources. Some previous studies reinforced our findings that WTPs estimates decreased with AN-A or without (Shen *et al.*, (2014); Hensher and Greene, (2010); Scarpa *et al.*, (2009); Gigerenzer and Gaissmaier, (2011); Schulte-Mecklenbeck *et al.*, (2013)).

For the upper and lower quartiles in terms of AN-A, the WTP lower quartile presents a cut of the entire distribution at the lower 5% which it is more negative and upper quartile 95% is more positive. It is observed in the table that the lower quartile has more negative values. This indicates that individuals are prepared to pay little for olive oil attributes except organic and country of origin, where they will pay more for those two attributes. However, the upper quartile values are statistically significant. From the table, it can be clearly noted that the upper quartile values are larger than the median values. This indicates that British consumers value higher quality attributes of olive oil and are willing to pay more especially for healthy foods such as organic (£1.80).

6.4.5 Willingness to Pay Estimation with SQ and Socio-Demographic Characteristics

In the previous section, the WTP estimation from mixed logit model was discussed without including socio-demographic characteristics. The following table reveals the WTP for three

specifications AF-A, AN-A and IR-A, including socio demographic characteristics. The objective of this table is to discuss how socio-demographic factors influence willingness to pay for the different characteristics of olive oil. Unlike other studies, which are based on postulated future behaviour, our findings are based on observed data concerning British behaviour.

Table 6.11: WTP Estimation Results with SQ and Socio-Demographic Characteristics

Variable	AF-A				AN-A				IR-A			
	Age	Household Size	Income	Gender	Age	Household Size	Income	Gender	Age	Household Size	Income	Gender
Price	1	1	1	1	1	1	1	1	1	1	1	1
Organic	-0.892	0.412	0.383	0.650	-0.431	0.837	0.568	0.935	-1.119	0.769	0.052	1.035
Italian	1.019	1.529	3.429	-1.585	1.167	0.477	3.423	-1.546	2.208	2.516	3.897	-2.897
Spanish	0.597	-0.553	0.296	-0.857	0.475	-0.337	0.536	-0.802	1.243	-0.505	0.325	-0.468
Greek	0.324	-0.541	-0.117	0.190	0.389	-0.756	0.182	0.102	1.060	-0.824	-0.373	0.292
Dark Green	-0.461	1.165	1.621	-0.422	-0.787	-0.884	1.568	0.696	-0.829	0.165	2.432	-0.901
Yellow	-0.550	0.753	1.221	-0.687	-0.538	-0.093	1.395	0.017	-1.120	-0.055	1.760	-1.087
Plastic	-0.047	-2.024	0.479	0.065	-0.271	-2.593	0.277	-0.444	0.162	-2.407	0.624	-0.426
Nutty	0.134	-0.259	0.083	0.058	-0.031	-0.395	-0.109	0.130	0.210	0.143	0.292	0.154
Bitter	-1.962	-0.071	1.429	-2.224	-2.100	-0.512	1.259	-1.997	-2.841	0.297	1.690	-2.622
Light	-1.268	0.188	0.308	-0.177	-1.268	0.128	0.314	-0.324	-2.159	0.692	1.022	-0.359
Standard	-1.369	-0.541	1.083	-0.782	-1.238	-0.640	1.000	-0.792	-2.023	-0.132	1.133	-1.080
Smooth	-0.055	-0.224	0.517	0.605	-0.184	-0.698	0.545	0.867	-0.086	-0.890	0.923	0.897
Fairtrade	-0.284	-0.929	0.229	-1.088	-0.022	-0.849	0.123	-1.464	-0.378	-1.231	-0.007	-1.635
SQ	0.620	-1.647	-0.513	1.173	0.658	-1.372	-0.432	1.235	1.615	-3.670	-0.531	2.788

Source: Survey Data, 2015. n = 412 respondents.

Table 6.11 reveals that older respondents are not willing to pay a price premium for organic olive oil in terms of three specifications (AF-A, AN-A and IR-A). Older respondents derive a negative sign on marginal utilities for organic olive oil and discounted olive oil labelled organic, by as much as 89 pence (mean $_{age}$= - 0.892 for AF-A) as opposed to non-organic olive oil. Older people are less likely to consider organic olive oil in their WTP (mean $_{age}$= - 0.431 for AN-A) than younger respondents. This implied that the demand for organic olive oil is strongly affected by age group. However, the influence of household size, income and gender groups on WTP is positive and statistically significant for the demand of organic olive oil. For example, male respondents are more likely to pay for organic olive oil than female respondents. (Mean $_{gender}$ = 1.035 for IR-A, mean $_{gender}$ = 0.935 for AN-A and mean $_{gender}$ = 0.650 for AF-A). Most previous studies reported that women are more likely to pay for organic olive oil; they purchase organic products more regularly than men do. It might be because women usually have the responsibility of doing the shopping in most households, and they are more informed and concerned about food health and safety. Other studies revealed that men are more likely to pay for organic products than women. It is difficult to explain the controversial results without knowing additional information, such as the income level for each household and their knowledge about organic olive oil. Zanoli *et al.,* (2013) found that socio-demographic categories do not affect consumer choices and their marginal utilities, except the gender

category; women have a higher tendency to pay more for environmentally friendly products than men do. The difference is statistically significant. Opposite to our finding, Loureiro and Umberger, (2004) found that women are more likely to pay more for CoO labelling than men.

Among the socio demographic characteristics, it appears that the older respondents, of a certain family size and high income show willingness to pay for country of origin, especially for Italian olive oil. For example, people with a higher income are willing to pay more for Italian olive oil and it is around £3.43- £ 3.90. The prior knowledge and reputation of Italian olive oil plays an important role in making the respondent pay more for the CoO. However, the gender group is a socio demographic factor that negatively affects the willingness to pay for Italian olive oil; it is between £-1.59 to £-2.90.

Regarding to the estimation, the influence of the income category on a WTP price premium is positively strong and has plausible levels of statistical significance for most of olive oil attributes. For larger-sized families (at least one child) and for young people WTP for attributes of olive oil are less significant. Previous studies by Duquenne and Vlontzos (2012), studied different socio-economic characteristics on consumer behaviour when buying olive oil in Greece, and they found that younger consumers have strong self – consumption trends when purchasing olive oil based on a specific attribute, more than older people do. However, contrary to our findings in terms of WTP for organic, Wandel and Bugge (1997) demonstrated age category with regards to purchase motives based on organic products. They pointed out that young consumers are more likely to buy organic products based on environmental considerations, while older consumers are more influenced by their own health and safety food. Idda *et al.,* (2008) pointed out in their study that single and small-sized households are more prone to purchasing organic products than larger families in their decision. They also found a positive relationship between the household size and WTP for purchasing environmentally friendly products. However, Davies *et al.,* (1995) found that there are no significant differences in purchasing organic products whether families have children or not. Loureiro and Umberger (2004) found that consumers with a high level of education and income were expected to be more likely to pay more for the country of origin attribute. Scarpa *et al.,* (2006) examined the observed heterogeneity for income, their results showed that WTP decreased for respondents who have many children and a low-income range.

To sum up, different results were revealed based on marginal utilities estimations and the influence of socio-demographic characteristics on WTP estimation. The effects of socio-demographic characteristics are as expected. Empirical results implied that WTP were positively affected by socio-demographic characteristics. The demand for organic olive oil is

strongly affected by socio-demographic characteristics especially for age group, where older people revealed unwillingness to pay a price premium for organic olive oil. However, the influence of household size, income and gender on WTP was positively strong and statistically significant. For example, men respondents are more likely to pay more for organic olive oil than women do. In addition, the influence of income category on a WTP price premium is positively strong and statistically significant for most of olive oil attributes.

6.5 Summary

To conclude the most important results and findings included in this chapter are:

Results from Debriefing Questions

1. It was found that 396 respondents out of 412 reported to have ignored at least one attribute; this indicates that attribute non-attendance is a dominant behaviour in our hypothetical choice experiment.
2. It was found that the preferences of British consumers under four socio-demographic characteristics increased the probability of attendance or non- attendance for some given attributes. For example, older British consumers and high-income people had a high propensity to consume organic olive oil. Their concern increased in terms of having a healthy and safe product. It was also found that British consumers did not prefer Syrian organic olive oil and they revealed their preferences for other olive oil origins.
3. Findings explain how socio-demographic variables influence the probability of giving a specific rank to an attribute, revealed that the preferences of British consumers under four socio-demographic characteristics increased the probability of importance ranking for some attributes. For example, age, income and size of household categories has increased the probability of organic olive oil to be ranked at the top of British consumers preferences. However, men have increased the preferences to the taste of olive oil more than women.
4. The outcomes for both models (AN-A, IR-A) are realistic and consistent. British respondents gave high importance ranking to less ignored attributes.
5. Results revealed that that some respondents do not recognise that they use price as a cue of quality, or they have adopted some other form of heuristic the nature of which is unclear.

Results from Mixed Logit Model and Willingness to Pay:

1. The model incorporating attribute non-attendance (AN-A) outperformed models that did not incorporate debriefing data and the model that incorporated rankings. Models that incorporated rankings outperformed models that used no debriefing information.
2. Mixed logit gave consistent parameter results across three specifications. British consumers exhibit strong preferences towards organic olive oil in terms of health and safety

food choice. However, British consumers did not prefer Syrian organic olive oil relative to other CoO.

3. British consumers are particularly willing to pay a price premium for having organic olive oil, which is between 29-39 pence more than non-organic olive oil.
4. British consumers are not willing to pay for Syrian olive oil.

Chapter Seven: Policy Implications & Conclusion

7.1 Introduction

Background information is included in chapter two. Previous empirical studies and the theoretical framework of discrete choice modelling have been reviewed in the literature review. Research methods are provided in the research methodology chapter and the econometrics Bayesian estimation for different specifications have been examined previously. A large part of the results discussion has been already done. The entire key finding is summarized in this chapter in section 7.2. Contribution of knowledge is included in section 7.3, the policy implications in section 7.4. This chapter provides some recommendations and suggestions for further research in section7.5 & 7.6. Finally, the limitations of the study are included in section 7.7.

7.2 Summary

Recently, the worldwide demand for organic olive oil has expanded rapidly and has taken a larger share of the market. It was stimulated by consumers who are concerned with issues relating to personal health, food safety and food quality. The largest growth of demanding organic products has occurred in the developed countries, such as the United Kingdom, which is considered a major importer for organic olive oil products. Organic olive oil is the product that this study is concerned with. It has a remarkable variety of health benefits, it is rich in vitamins, minerals, antioxidants and other nutrient's components.

In Syria, as a Mediterranean country, olive tree cultivation occupies the number one place among fruit trees. In the last few years and before the conflict in 2011, the olive crop was considered a strategic crop due to its importance as a secure food source for Syrian people and its valuable addition to the national income (SEF, 2016). Syria occupied the fourth rank internationally in the production of olive oil until 2011, therefore, the stability of consumption on Syrian olive oil market gives an opportunity for marketers and operators to look abroad in order to find the potential for marketing Syrian organic olive oil to non-traditional markets such as UK. The growing demand on organic olive oil based on changing of food habits and consumption towards healthier and safer products could provide a justification to encourage Syrian farmers to leave the conventional methods in planting olive trees and move to organic agriculture. It will also help the Syrian marketers and operators to provide an organic certification and labelling and create new export business opportunities in non-traditional market in the UK.

Throughout the current study, we have sought to identify the key issues and constraints facing Syrian olive & the olive oil sector and the opportunities for Syrian olive oil production (organic in particular) in relation to domestic and international markets with particular focus on the potential export within the UK market. An attempt has been made to explore the potential role of the government and decision makers to encourage Syrian farmers to move from the conventional method to organic methods. Different olive oil market trends have been discussed and the implications of market trends on Syrian export olive oil were also discussed in chapter two.

The first objective of this study investigated the preferences of British consumers towards organic olive oil in general and Syrian organic olive oil in particular. In order to achieve the main aim of this study, two qualitative methods, which include focus group discussion and verbal protocol analysis, have been conducted. In addition, the data was collected through an online survey from British respondents in the United Kingdom. The stated preference technique was used for a series of hypothetical scenarios presented in Choice Experiment (CE). Respondents were asked to make trade-offs between changes in the levels of range of attributes. The discrete choice model based on Random Utility Theory (RUT) helped to evaluate Willingness to Pay (WTP) a price premium for organic olive oil and other attributes of olive oil products. The Mixed Logit, Probit Model and Ordered Probit Model were employed to analyse choice experiment outcomes using the Bayesian econometrics approach. Three model specifications of the standard mixed logit model were included in terms of scale heterogeneity of variance, stated Attribute Non-Attendance (AN-A) and Importance Ranking of Attribute (IR-A). Overall, Results revealed that attribute non-attendance is a dominant behaviour in choice experiment. Findings showed that British people prefer organic olive oil in general and they are willing to pay for this attribute related to their concern about health and safety food products. However, consumers were unwilling to pay a price premium for Syrian organic olive oil. A strong evidence has been revealed in this study that British people did not consider a high price of olive oil as a cue for high quality.

The link between research objectives and the empirical findings is as follows:

1- ***Research Objective One: To investigate the preferences of British consumers towards organic olive oil in general and Syrian organic olive oil in particular.***

Two qualitative methods were conducted to identify the most important attributes and their levels which used the choice experiment application and to get a better understanding of British consumer preferences. Focus group discussion and verbal protocol analysis were conducted as

a part of the research methods and helped towards a better understanding of British consumer preferences and acceptance for the different attributes of olive oil product.

The main findings from focus group discussion summarised that the British consumers were concerned about health benefits and they used olive oil for cooking and daily life uses. While in terms of olive oil knowledge, UK people are generally not well informed about olive oil grades. However, in terms of purchasing behaviour, they considered many attributes when they buy olive oil product such as price, organic or non-organic, country of origin, colour.

The main findings from verbal protocol analysis were that British consumers mainly used olive oil for cooking, marinades and salad dressings and drizzling over meat, fish and pasta. UK consumers were really concerned about health and safety organic olive oil. They used their previous experience to choose some specific brand name related with country of origin. However, a minority of British people do not know what the difference between organic and non-organic.

Findings from the mixed logit model revealed that the robust parsimonious statistical model is attribute non-attendance (AN-A). Mixed logit results revealed that the attribute parameters are consistent for three specifications. For the superior model that is AN-A, British consumers have positive sign and statistically significant to organic olive oil in terms of personal health and environmental protection. However, British consumers did not prefer Syrian organic olive oil relative to other CoO.

2- *Research Objective Two: To evaluate the willingness of British consumers to pay a price premium for organic olive oil in general and for Syrian organic olive oil in particular; using stated preference methods through the application of discrete choice experiment.*

Eliciting different perspectives of British consumers' preferences were investigated under stated preferences methods. Syrian organic olive oil does not exist yet in the UK market, this made stated preference method being the best method to be used in this study. Discrete choice experiment application was applied successfully for nine attributes of olive oil and with different levels for each attribute. Different combinations of olive oil attributes and their levels were presented to the UK population on an online survey. The Bayesian econometrics approach was used to analyse the data set. Discrete choice model based on the random utility theory helped to evaluate willingness to pay a price premium for organic olive oil and other attributes of olive oil products.

The main finding revealed that respondents have positive and significant signs for organic olive oil and some of the other attributes. For the best model performance, British consumers are willing to pay a price premium for organic olive oil 39 pence more than non-organic olive oil.

However, British consumers did not attach any interest and preference for Syrian organic olive oil and according to that they are not willing to pay a price premium for this product.

3- *Research Objective Three: To investigate the effect of including heterogeneity scale and Attribute Non Attendance (AN-A) and Importance of Ranking Attributes (IR-A) on willingness to pay concept in the context of DCE.*

In this part, the study estimates willingness to pay for three specification AF-A, AN-A and IR-A, including the observed heterogeneity through socio-demographic characteristics. The objective here is to discuss how socio-demographic factors influence willingness to pay for the different characteristics of olive oil.

Findings revealed that older respondents are not willing to pay a price premium for organic olive oil in terms of three specifications (AF-A, AN-A and IR-A). Older respondents derive a negative sign on marginal utilities for organic olive oil and discounted olive oil labelled organic, by as much as 89 pence (mean $_{age}$= - 0.892 for AF-A) as opposed to non-organic olive oil. Older people are less likely to consider organic olive oil in their WTP (mean $_{age}$= - 0.431 for AN-A) than younger respondents. This implied that the demand for organic olive oil is strongly affected by age group. However, the influence of household size, income and gender groups on WTP is positive and statistically significant for the demand of organic olive oil. For example, male respondents are more likely to pay for organic olive oil than female respondents. (Mean $_{gender}$ = 1.035 for IR-A, mean $_{gender}$ = 0.935 for AN-A and mean $_{gender}$ = 0.650 for AF-A). In addition, the influence of the income category on a WTP price premium is positively strong and has plausible levels of statistical significance for most olive oil attributes. For larger-sized families (at least one child) and for young people WTP for attributes of olive oil are less significant.

Overall, the effects of socio-demographic characteristics are as expected. Empirical results implied that WTP were positively affected by socio-demographic characteristics. The demand for organic olive oil is strongly affected by socio-demographic characteristics especially for age group, where older people revealed an unwillingness to pay a price premium for organic olive oil. However, the influence of household size, income and gender on WTP was positively strong and statistically significant. For example, men respondents are more likely to pay more for organic olive oil than women. In addition, the influence of income category on a WTP price premium is strong and statistically significant for most of olive oil attributes.

4- *Research Objective Four: To investigate whether respondents continue using the price of olive oil as a cue of quality or not in the purchasing process based on the discrete stated choice experiment.*

Respondents were asked to answer a 'dominated choice card' (always the seventh in the sequence) where the options had the same attributes levels except for the price attribute levels. The first price option was the level of £3.16. The second price option was the level of £2. The third price option was the level of £5.30. The last option was "I do not know" (See choice card seven in Appendix 4). The underlying construction of the CE assumes that it is rational for respondents to go for the cheapest option where all other attributes are the same. Findings in table 7.7 revealed that the majority of the British respondents, which account for 280 respondents, preferred to choose the cheapest price (£2 for 500ml). However, 18 respondents preferred the highest price £5.30, and 89 respondents choose £3.16 for 500ml.

The fact that many respondents did not go for the cheapest price means that there is some evidence that some consumers were using price as a quality cue. On the other hand, only a few respondents went for the highest price, perhaps meaning that respondents considered price as a cue of quality, but that choosing a middle price option was a viewed good balance between quality and 'value'. The marketing literature has long considered price as a potential cue of quality. However, from a pure CE perspective, this behaviour is viewed as 'irrational', since only non-price attributes are supposed to be the sole embodiment of 'quality'. The behaviour we have observed here may be symptomatic of a wider phenomenon within CEs that reflect the fact that no matter how wide the attribute set, respondents imagine there to be other attributes to the product that are not included within the CE. Thus, the attributes that are included not only have a direct signal in terms of the utility provide, but provide a cue about attributes that are perceived as "missing". The implications of using price as a quality cue means that the WTPs for the attributes within the experiment are inflated, and perhaps the relative WTPs are biased as well.

The fact that some respondents went for the higher price option does not necessarily establish that they were using price as a quality cue. It is possible that they were adopting a heuristic approach that went for "middle" options (or were simply making random choices). To shed further light on this issue, the responses to 'Card 7' need to be compared to other responses elicited from respondents. Therefore, the relationship between responses to the dominated card were evaluated in the light of responses from debriefing questions (attendance and ranking of attributes) but also from an open-ended question to respondents about whether they considered the price of olive oil is an indicator of quality.

Results obtained from an open – ended question revealed the number of respondents were classified into three groups. By taking these answers respondents were either have deemed to responded: i) in a way that indicated that they used the price as an indicator of quality; ii) a way that indicated that they did not use price as a quality cue; or, iii) a way that indicated neither.

Regarding to attendance (or stated non-attendance), results in table 7.7 revealed that respondents who ignored the price attribute is 49 respondents out of 412. On the other hand, the majority of respondents attend the price attribute 363 respondents. The relationship between respondents' preferences who attend (or ignore) price attribute and respondents' preferences who place their choices at different price levels (i.e. choice card 7); it was noted that the majority of respondents (363 person), who attend the price attribute, have a strong tendency to choose the cheapest price level £2. This indicates that respondents focus on their choices on a specific level of price attribute £2, and it might tend to ignore other levels. The implication provides in this case insights into how respondents place the quality feature in their choices based on a price level (i.e. £2). Respondents may not believe that the high price indicates a higher quality, therefore respondents' choice is consistent and ideal in choice set seven, *ceteris paribus* assumes no other attributes change. This finding could support the belief that consumers are not consider the higher price the better quality in a variety of quality features of olive oil.

On the other side, it was consistent in our DCE that the minority of respondents (49 respondents) revealed that the price is being ignored. Because ignoring price attribute in CE, it may result a problem for the computation of WTP, respondents do not make any trade-off required for WTP estimation. Sometimes the reason beyond stated AN-A for the price attribute might be that the price has a limit range in consumers'' mind for buying process. Rose *et at.*, (2005) noted that when a specific attribute is being ignored, then the marginal utility of WTP is zero for that attribute, and when the price attribute is being ignored then WTP come to be infinite. Accounting for AN-A leads to significantly lower WTP estimate (Balcombe *et al.*, 2011; Scarpa *et al.*, 2009; Campbell *et al.*, 2008) or maybe higher WTP estimation (Hensher *et al.*, 2005a; Hensher and Green, 2010).

In terms of importance ranking for the price attribute, results revealed the number of respondents who gave a number one for highest importance price ranking and a number nine for the lowest importance and its percentage. Respondents who rank price attribute as a first/second/third important are account for 189, and 64 respondents (16%) who gave the price the lowest importance ranking. The relationship between respondents' preferences who ranking price attribute and respondents' preferences who place their choices at different price levels (i.e. choice card 7) was noted that respondents who gave a lower importance ranking to the

price attribute have a strong tendency to choose the cheapest dominant price level (£2). This implies a consistency in the respondents' behaviour. However, the inconsistent results are apparent when respondents consider the price at the highest important ranking, and placed their choices to the cheapest dominant price level (£2). This indicates that the degree of association between ranking price attribute and respondents' choices and preferences are not strong enough. People may employ different response heuristics when they made their decision or they might state differently to what they actually behave. This implies how the price attribute affect consumers behaviour at final decision.

Form these results; it can be noted clearly that there is a strong tendency for the majority of the people who attend the price attribute to choose the cheapest dominant option. In addition, the respondents who gave lowest rank for the price might choose the cheapest olive oil price. Therefore, people in terms of attendance and lowest ranking price attribute are consistent with their choices and preferences in choice experiment. Overall, the conclusion is therefore that some respondents do not recognise that they use price as a cue of quality, or they have adopted some other form of heuristic the nature of which is unclear.

7.3 Contribution of knowledge

This thesis contributes to organic olive oil in general and to Syrian organic olive oil in particular since it is one of the few so far that have provided an insight into the olive oil market and which have gathered information and knowledge with regard to the supply side (Syria) and the demand side (UK) in the market. The study obtains a better understating of British consumer behaviour for the different attributes of olive oil products included in the choice experiment. In addition, investigating the British willingness to pay more for Syrian organic olive oil. This study contributes to investigating a new method whether British consumers use a high price to infer a higher quality or not in terms of stated attribute non-attendance and importance ranking for price attribute. This research has shed light on the most important issues facing Syrian farmers and marketers in their production of high quality olive oil and whether it can compete with other brand names in the Mediterranean basin and find the potential for marketing Syrian olive oil abroad

7.4 Policy Implications

Findings from this study offered important information about British consumers' preferences and the potential for marketing Syrian organic olive oil within the UK. There are some policy implications from results and findings:

1- The results obtained in the current study suggest that most of consumers' preferences in the UK are concerned about health and safety food choice which is, in this study, organic olive oil. Consumers also prefer country of origin and taste of olive oil while they did not show any particular interest in Syrian organic olive oil in their preferences. In order to address the potential market and policy implication for Syrian organic olive oil. The results may help policy makers in the debate over the need for the organic attribute more than the country of origin based on consumers' preferences and interests. Our findings underpin the idea that organic choice of olive oil is the main driving force for British consumers and it will help consumers in their final decision to pay more for organic labelling existing in the UK rather than that provided by country of origin (Syrian) label. Results also suggest an increase the British consumers' knowledge about organic olive oil rather than other attributes (CoO), therefore the market strategies should be targeted to increase the consumption of olive oil based on organic aspects more than CoO. Recently, *The Economist*, (2012) discussed the spread of the appetite for olive oil beyond the Mediterranean region. According to results revealed in this study, this implies that consumers need to know more about the health and culinary benefits of organic olive oil imported from Mediterranean countries regardless of which country it comes from, this can significantly contribute to an increasing demand for organic olive oil in the UK and help make consumers more aware of the good attributes of olive oil, it will raise the chance for Syrian organic olive oil to market in the UK based on being organic, from the Mediterranean area rather than being from Syria.

Another marketing strategy which could help the potential for marketing Syrian organic olive oil in Britain is by giving greater symbolic insight into organic food purchasing through the safeguard of traditional Mediterranean products (Idda *et al*., 2008). Both olives and olive oil have a noticeable place in the cultures of the countries in the Mediterranean and it is well known that the Mediterranean diet is healthy, leading to well-being and long life and this idea needs to be promoted more to encourage the use of olive oil products in the UK. The results also gave consideration of other attributes such as taste, flavour, colour, Fairtrade in order to infer consumers' preferences such as the taste and Fairtrade and colour of olive oil. For example, in order to make the buying decision, consumers are not able to ascertain the taste of olive oil before buying the product, while after buying the product, it might lead to a good experience about the quality of the product which would then lead to a repetition of the buying process. It is useful in terms of making the British consumers recognize that the good quality of Syrian olive oil is based also on other attributes like taste or colour. The organic attribute cannot sell itself but it needs efficient and customized marketing strategies; good information about Syrian olive oil, promotion and price policies in order to help the provision Syrian organic olive oil in

the market. If Syrian organic olive oil gains from media attention, this attention may be used to benefit high quality exporters from Syria. Improving the quality aspect and the reputation of Syrian olive oil in the new consumption market (UK) could increase the profits and returns for Syrian farmers as well as for marketers and processors of olive oil products.

2- The evidence provided by the current study shows that the British people are not willing to pay a price premium for Syrian organic olive oil while they are willing to pay for the country of origin such as Italian or Spanish olive oil. In thinking about price, there are two points to be considered before establishing a price strategy for Syrian organic olive oil, the first point, the current study includes a hypothetical experiment and it is not in a real market, so it is worth to have a plan to have a greater knowledge of what British consumers preferences and needs would be. For this point, the current research was conducted into two qualitative methods (focus group and verbal protocol analysis).

The second point is whether the Syrian organic olive oil in a competition with Italian or Spanish brand names or not. The policy implication is that with a totally new product like Syrian organic olive oil, two main strategies are the most common for setting prices in the market; the lowest price for Syrian product compared with Italian or Spanish brand names, this strategy is called "penetration pricing", it is a technique where Syrian organic olive oil can be provided relatively well in the market at a lower initial entry price, and often less than Italian or Spanish olive oil prices, according to that the demand on a Syrian product will increases at the lower prices. This strategy could catch the attention of the British consumers who are looking for a good quality product at a lower price and it might work well in the expectation that consumers will switch to the new product with the new brand name because is at the lower price. Syrian organic olive oil is still at an early developmental stage and this strategy might work well in the long term distribution of Syrian products in the UK market and it will give rich opportunities for Syrian olive oil to be different from other brand names. If results can be achieved in a fast diffusion and adoption, possibly that the market for Syrian olive oil products will become more widespread then there will be a high potential for Syrian organic olive oil to be marketed within the UK.

The second price strategy is that British olive oil market should establish the highest price for Syrian organic olive oil. The issue of setting high price for Syrian organic olive oil, in the existence of competition, is the reaction of other business companies such as the famous Italian and Spanish companies. They may react immediately by improving their products or may cut the prices instead. However, if there is not much competition, then it is much easier to keep a high price for Syrian organic olive oil. This in its turn will help to gain high profits and returns. This strategy would be useful in terms of having a high premium for the organic new product

which includes the production cost and materials and having a high demand of product. As a result, consumers' WTP for organic olive oil attribute could help in changing consumer attitudes together with a good strategy of pricing for Syrian organic olive oil. However, those two pricing strategies may not always work correctly in comparison with other factors such as the size of organic market (niche), the benefits of the product and the consumers' satisfaction.

3- The empirical results yielded by the mixed logit model suggest that the influence of the income category on WTP a price premium are positively strong and statistical significance for the most of olive oil attributes. While the large family size (at least one child) and for young people are less significant on WTP for all attributes of olive oil. In a particular sense, the demand for organic olive oil is strongly affected by age group. However, the influence of household size, income and gender groups on WTP are positive and statistically significant for the demand of organic olive oil.

In most preference studies, it is useful to account the preference observed heterogeneity (e.g. socio-demographic characteristics) which improve the performance of model significance. In the current study, it does not improve the model fit but it gives useful information about the target market of olive oil products. Once the target market is defined through different demographic characteristics (market segmentation) on some similarity or commonality, then it will be easier to define the type of consumers and their preferences and needs (especially for age and income groups).

According to our results, older people seem to be less WTP for organic, it might be due to the expensive price for organic olive oil rather than the conventional one. This implies that market strategy should encourage marketing companies to target young people in an attempt to create new olive oil habits and focus on some health and safety attributes such as organic. These findings imply that the strategy might be to target older people who are attracted by symbolic motives to protect traditional Mediterranean products in which Syrian organic olive oil is considered one of those products. This could increase the demand for Syrian organic olive oil in the emerging UK market. A good market strategy is usually focused on providing advertisement for the new product to reach a specific market segment. For example, in the current study, it was found that high income people are willing to pay more than the lower income people, therefore, the strategy for marketing Syrian organic olive oil should be targeted to high income British people because the purchasing power of those consumers will be higher based on the level of income earned. The method to have different perspectives of WTP and implications for olive oil attributes through different characteristics of people might not be accurate and may not give a reliable indication of the demand for specific products such as Syrian organic olive oil. Most frequently, people do not know what they would pay for. Mainly

it depends on the income category where consumers with high income tend to pay more for expensive, high quality products.

4- Results from the empirical current study suggest policy implications and conclusions about British consumers evaluating the quality of olive oil based on the price. Results revealed that respondents who placed their choice and preferences based on price attribute level (£2) are not ignoring the price attribute and give a lower importance ranking in our CE. In food choice context, results indicate that the British consumers did not consider the higher the price the better the quality of product. This finding implies that the price is of course an important attribute for the majority of respondents, as mentioned earlier, so the market strategy should act strategically in terms of providing Syrian organic olive oil in the market at the cheapest price level. This can help consumers based on their behaviour and preferences. There is another price strategy might help in this case, to offer discount for Syrian organic olive oil in the market. This strategy will work effectively if the consumers tried the Syrian organic olive oil product and then repeat buying the product. Results also imply that focusing on making trade-offs between other attributes which also present a good quality of olive oil.

7.5 Recommendations

Since the presence of Syrian organic olive oil is still very limited in the Syrian domestic market and does not exist yet in the UK market. The results suggest a number of interesting points and some recommendations are given to introduce Syrian olive oil products in the market most effectively.

1. Help Syrian farmers and olive producers in moving from conventional farming methods to organic farming methods to ensure a healthy food supply and a sustainable future. It will help marketers' and processors also to have an organic certification scheme which is important to open the door for the Syrian organic olive oil to exist in an international market.
2. Represent high quality product and positive image of Syrian organic olive oil: olive oil is currently considered in most international market a high-quality alternative to other edible oils and fats. The efforts should be to improve the quality of olive oils into different dimensions; such as heath, taste, safety, etc, especially that the tradition Mediterranean diet focus on olive oil characteristics and its contribution in resisting number of chronic diseases, therefore, producers, exporters and traders should pass these different characteristics of olive oil to consumers in order to increase the awareness of these attributes.
3. High technological level of the processing industry: create Syrian companies for organic olive oil which can deal with environmental issues and foreign industry structures. It can work

on the basis that the olive oil products can be produced to meet the international demands, not only work for domestic consumption.

4. Increase Syrian participation in the world market: increase the world agriculture trade in Syria especially in terms of organic olive oil. It is important to make sure that a Syrian organic olive oil development program, being proposed in a company has a prospective financial return proportional with the degree of risk of including a new product in the market.

5. Strength the marketing strategies and chain management of olive oil industry: consumers preferences in non-tradition market (UK) vary significantly between different countries of origin and among consumer segments within each country, therefore, producers and marketers should try to adapt the olive oil (type, colour, taste, etc) promotion and other marketing variables to the specific circumstances in each target market.

6. In order to increase the export activities of Syrian organic olive oil product, the marketing companies should focus on their strategy for participating in promotional campaigns in the UK market, through TV, the internet, magazines and through participation in exhibitions, to inform the British consumers about the superior quality of Syrian organic olive oil, for example, introduce a new brand name such as "Syrian organic olive oil" into the UK market.

7. An important undertaking is to offer more information to increase British consumers' knowledge of what organic olive oil is, how to distinguish this product in the market place and what are the health benefits of consuming organic olive oil products.

8. The olive oil industry has to adopt some strategies in terms of facing the weakness of olive oil sector, for example, in Syria as a producer country, the olive oil demand is stable in its quantity, processors and operators should make efforts to add value by supporting consumption of high-quality oils. Also, the companies and institutions should increase demand in non-tradition market like UK market, bearing in mind that the price will be higher in new market than local market.

7.6 Suggestions for Future Research

Since the situation in Syria is unstable, it is possible that the present findings and results cannot be implemented to a large extent. An actual choice experiment different from what was proposed in our study will help to provide more perceptions, attitudes and preferences about British consumers' behaviour on purchasing processes.

Academically, there are many suggestions which provide opportunities for further research based on the current findings about the Syrian organic olive oil market and British consumers' preferences for health and safety food choices. The current study proposed a new opportunity for Syrian organic market to be exist in the UK. The increasing demand for olive oil worldwide

as well as the demand for healthy, high quality products, constitute a positive context for the development of olive oil sector, for example, giving more subsidies for olive oil reform will help to improve the quality of olive oil and strengthen environmental benefits along the olive oil supply chain. In addition, the growing liberalisation of global agricultural marketplaces will provide good opportunities to Syrian companies, this, in its turn, will increase the export activities and enhance the price competitiveness and control over the global markets. For more liberalised world markets, all companies and public institutions may try to reach a specific market segments such as niche organic market. Technological developments supposed to speed up business operations and improve customer service. It will be sensible to look beyond the current study and explore the possibility of generalising our results to other organic products such as vegetables and fruits and not only be limited to organic olive oil. Also, more future research is needed to elicit true preferences for Syrian organic olive oil not based on a hypothetical experiment.

7.7 Limitations of Study

In spite of high efforts to design choice experiment research methodology and control the circumstances during the study time, there were a number of obstacles that prevented this study from being perfect. Some difficulties have faced this research in terms of applying qualitative methods to identify the attributes of organic olive oil and their levels such as verbal protocol analysis (VPA), recording a video tape of the interviews would complete the procedure of this method more extensively. However, it was quite difficult to obtain permission from the hypermarket owners to conduct the research in this way in order to record our interviews successfully. It was confined only to tape recordings and transcribing the written notes.

In the context of choice experiment, there are some factors which can influence the value of marginal utilities estimations, for example, the number of alternatives (options) in the choice sets, the number of olive oil attributes and their levels which were presented to respondents. One issue emerged about steering the stated preference method in the current research. It was assumed that respondents would answer a number of tasks, the respondents might find the questions complicated and become disinterested in answering them. The complexity of these tasks as well as the cognitive burden may make the respondents try to simplify their decisions by using heuristics rules, this in its turn, will affect the results of CE.

A key potential obstacle of the current choice experiment study was that the choice questions were dependent on hypothetical scenarios. Accordingly, respondents' choices might not truthfully reflect their actual behaviour in the real market. Also, the number of attributes (nine)

and their different levels might be a challenge to respondents to understand and make trade-offs between all of attributes of olive oil product.

In spite of these limitations, I believe that the current research study contributes to a better understanding of British consumers' preferences and the possibility for a potential market for Syrian organic olive oil.

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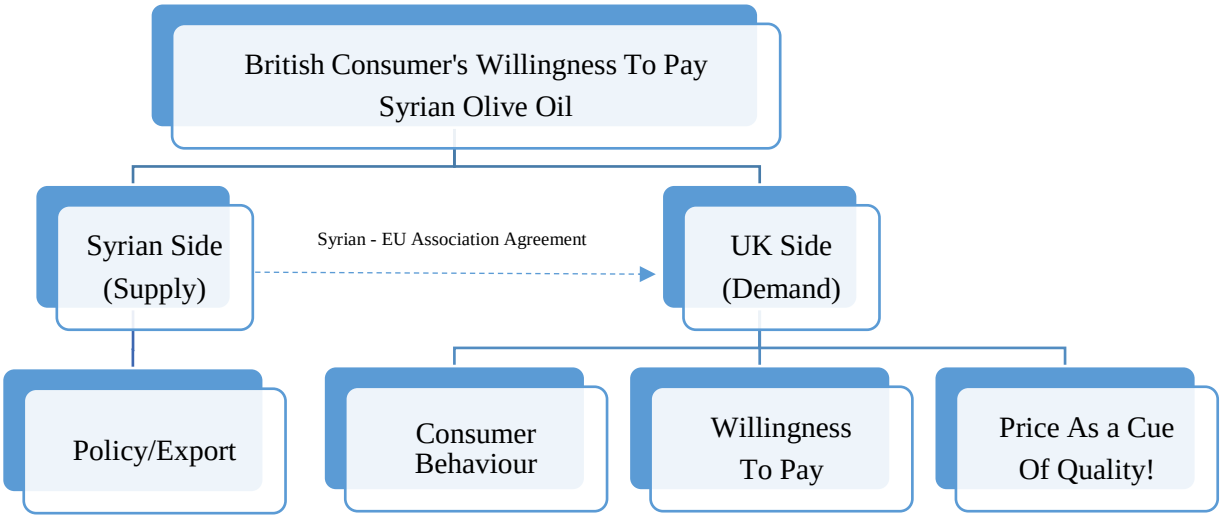
Appendix One: Conceptual Framework of Thesis



Appendix Two: Focus Group Protocol

Focus Group Protocol of British Consumers' Willingness to Pay for Syrian Organic Olive Oil

University of Reading

School of Agriculture, Policy and Development

Department of Food Economics and Marketing

Focus Group Protocol of British Consumers' Willingness to Pay for Syrian Organic Olive Oil

2013

By: Razan Majar

2.1. Focus Group Logistics

2.1.1. Inviting and Confirming Focus Group Participants

Invitation letters for focus group participants will be sent to potential participants via email two weeks before the focus group meeting via Sensory Dimension Ltd Company. Those who are willing to proceed will be asked to sign and return via email a consent form to confirm their participation.

A reminder email will be sent to participants two days prior to the scheduled date of the focus group meeting.

2.1.2. Invitation Letter for Focus Group Participants

School of Agriculture, Policy and Development

Dept of Food Economics and Marketing

University of Reading, Earley Gate

Whiteknights, PO Box 237

Reading, United Kingdom

RG6 6AR

Tel: 0118 378 4549

Fax: 0118 935 2421

25th October 2013

Study Title: Focus Group Protocol of British Consumers' Willingness to Pay for Syrian Organic Olive Oil.

Dear Sir / Madam,

My name is Razan Majar. I am a doctoral candidate in the Department of Food Economics and Marketing at the School of Agriculture, Policy and Development at the University of Reading. I am conducting a research study as part of the requirements of my degree in Agricultural Economics, and I would like to invite you to participate in a focus group discussion about buying olive oil. Participants will be asked questions about the attributes of olive oil, their willingness to pay for this product and the constraints affecting their purchase decision.

The group consists of 8-10 British consumers selected from the Reading area via Sensory Dimension Ltd Company. The collected information will be used to gain a better understanding of people's attitudes and preferences concerning olive oil, and will help inform the design of a questionnaire for my research study. The focus group meeting will take place at the Harold Casey seminar room in the Department of Food Economics and Marketing at the University of Reading's School of Agriculture, Policy and Development, and should last about 90 minutes.

Your name and answers will remain anonymous and your identity will remain confidential during the analysis and presentation of my study's data and results. Your participation is completely voluntary and you are free to withdraw from the interview at any time without providing a reason

The group discussion will be recorded, and the recording from your participation will be used for research purposes. It will be stored on a password protected university computer and one copy will also be saved on an external CD as a back up. Only the researcher and the supervisors have the permission to access my data. All the saved recordings will be destroyed after five years.

This research has been reviewed according to the procedures specified by Reading University Research Ethics Committee and has been accorded ethical clearance. By participating in this research you are acknowledging that you understand the terms of participation and that you consent to these terms.

The research results and findings will be published in international journals and this is in its turn will not affect your privacy. I would be happy to answer any further questions you have about the discussion and my study. You may contact me by phone: 0118 378 5038 or by email: Razan.Majar@pgr.reading.ac.uk

The focus group takes place on 25 October at 11:00 am at the Harold Casey seminar room in the Department of Food Economics and Marketing at the University of Reading's School of Agriculture, Policy and Development.

If you decide to participate, please sign the attached consent form and return it to Razan.Majar@pgr.reading.ac.uk

Thank you for your consideration.

Kind regards,

Razan Majar
School of Agriculture, Policy and Development
Dept of Food Economics & Marketing
University of Reading, Earley Gate
Whiteknights, PO Box 237
Reading, United Kingdom
RG6 6AR
E-mail: Razan.Majar@pgr.reading.ac.uk
Tel: 0118 378 5038

Supervisors at Reading University:

1. Prof Kelvin Balcombe	**2. Dr C S Srinivasan**
School of Agriculture, Policy and Development Dept of Food Economics & Marketing University of Reading, Earley Gate Whiteknights, PO Box 237 Reading, United Kingdom RG6 6AR E-mail: K.g.balcombe@reading.ac.uk Tel: +44 (0)118 378 8298	School of Agriculture, Policy and Development Dept of Food Economics & Marketing University of Reading, Earley Gate Whiteknights, PO Box 237 Reading, United Kingdom RG6 6AR E-mail: c.s.srinvasan@reading.ac.uk Tel: +44 (0) 118 378 8966

Reference Number: …

2.2 Information Sheet and Consent Form

Study Title: Focus Group Protocol of British Consumers' Willingness to Pay for Syrian Organic Olive Oil.

Objective: The objective of my research is to obtain from the participant's valuable inputs about buying organic olive oil in general and Syrian organic olive oil specifically. Participants will be asked questions about the attributes of olive oil, their willingness to pay for this product and the constraints affecting their purchase decision.

Description of the Methods: The group will consist of eight to ten participants and it will allow a free discussion between participants in terms of their viewpoints, attitudes and opinions in relation to issues of organic olive oil and Syrian organic olive oil. The collected information will be used to inform the design of questionnaire and choice cards for the purposes of a larger research study on consumer behaviour toward organic olive oil and the willingness to pay more for this product.

Selecting the Participants: The participants are selected from Reading area via Sensory Dimension Company. Each group discussion will last approximately 90 minutes. The sample size is between 8-10 participants, both male and female, aged 25-65 years.

Participation and withdrawal: Your participation is completely voluntary; you are free to withdraw from the group discussion at any time without needing to provide a reason. Any contribution can be withdrawn at any stage and removed from the research if desired. If you wish to withdraw, please contact me on details below, quoting the reference at the top of this page. The reference will only be used to identify your interview and will not reveal any other information about you.

Confidentiality and security of information: Your name and all the answers will remain anonymous and your identity will remain confidential during the analysis and presentation of my study's data and results. All the information collated from your answers will be used by the supervisors and me, and will not be shared with anybody else.

Recording and saving the data: The protocol will include recorded observations (written, audio, or video recordings). The recorded data will provide information regarding the ways consumers express their thoughts when discussing the purchase of organic olive oil. The recordings from your participation will be used for research purposes and they will be stored on a password-protected university computer. One copy will also be saved on an external CD as a backup copy. Only the researcher and the supervisors will have permission to access my data. All saved recordings will be destroyed after five years.

Consent form: You have been informed of and understand the purposes of my research project and you have the right to refuse to answer any question if you feel uncomfortable.

By signing below, I agree to participate in the focus group under the conditions mentioned above.

Printed Name:
Signature:
Date:
By signing below, I consent to allowing the focus group to be digitally audio-recorded.
Printed Name:
Signature:
Date:

Research Ethics Committee: This research has been reviewed according to the procedures specified by Reading University Research Ethics Committee and has been accorded ethical clearance. By participating in this study you acknowledge that you understand the terms of participation and that you consent to these terms.

Contact details of the investigators: The research results and findings will be published in international journals and this will not affect your privacy and secrecy. I would be happy to answer any further questions you have about the interview and my study. You may contact me on the address below:

Razan Majar

School of Agriculture, Policy and Development
Dept of Food Economics & Marketing
University of Reading, Earley Gate
Whiteknights, PO Box 237
Reading, United Kingdom
RG6 6AR
E-mail: Razan.Majar@pgr.reading.ac.uk
Tel: +44(0)118 378 5038

Supervisors at Reading University:

1. **Prof Kelvin Balcombe**	2. **Dr C S Srinivasan**
School of Agriculture, Policy and Development Dept of Food Economics & Marketing University of Reading, Earley Gate Whiteknights, PO Box 237 Reading, United Kingdom RG6 6AR E-mail: K.g.balcombe@reading.ac.uk Tel: +44 (0)118 378 8298	School of Agriculture, Policy and Development Dept of Food Economics & Marketing University of Reading, Earley Gate Whiteknights, PO Box 237 Reading, United Kingdom RG6 6AR E-mail: c.s.srinivasan@reading.ac.uk Tel: +44 (0) 118 378 8966

2.3 Reminder Email for Focus Group Participants

Date and Time: Friday 25th October at 11:00 am.

Study Title: Focus Group Protocol of British Consumers' Willingness to Pay for Syrian Organic Olive Oil.

Dear _____,

Thank you for your willingness to participate in the focus group meeting for my project titled: *The willingness of British consumer behaviour to pay a price premium toward organic olive oil in general and for Syrian organic olive oil specifically*.

This is a gentle reminder of our upcoming focus group meeting at the Harold Casey seminar room at 11:00 am, at the Department of Food Economics and Marketing at the School of

Agriculture, Policy and Development at the University of Reading. When you arrive, please remember to sign in.

If you are unable to attend for any reason, please let me know as soon as possible. Otherwise, I look forward to seeing you.

Kind regards,

Razan Majar

School of Agriculture, Policy and Development

Dept of Food Economics & Marketing

University of Reading, Earley Gate

Whiteknights, PO Box 237

Reading, United Kingdom

RG6 6AR

E-mail: Razan.Majar@pgr.reading.ac.uk

Tel: +44(0)118 378 5038

2.4 Recruiting the Participants (via Sensory Dimension Ltd Company)

Question 1: Have you attended a focus group discussion before?

Yes		Close
No		Continue

Question 2: Do you buy usually organic products?

Yes		Continue
No		Close

Question 3: Are you willing to participate in a focus group which discusses the consumer preferences and perceptions and attitudes towards consuming Syrian organic olive oil in the UK?

Yes	
No	

2.5 Conducting the Focus Group

The focus group discussion will be conducted by a team consisting of the researcher (Razan Majar) and two facilitators. The moderator will work to facilitate the open discussion and the facilitators will determine the agenda (time), running the tape recorder during the session, and writing notes just in case a mistake happens during the session. Recorded notes will help to prepare the summary and the report of data analysis. The data will be stored on a university

computer and one copy will be saved on an external CD as back up copy. Only the researcher and the supervisors will have permission to access to my data. All saved recordings will be destroyed after five years.

2.5.1 Focus Group Protocol: Consumer Preferences of Syrian Organic Olive Oil

2.5.1.1. General Instructions

1) Focus Group (FG) consists of eight to ten participants from Reading, UK. Its duration will be 90 minutes and will be divided into four stages. The time for each part is included. The FG environment will be comfortable for each participant.

2) Progressive numbers refer to the issues to be covered. Depending on the environment of the discussion and the cultural context, the researcher is aware that some modifications might be needed in regards to some of the questions.

3) The group session is preceded by participants filling in short individual forms. These forms will not be used during the group discussions. (see forms below)

4) The FG is guided by the moderator. Text in italics contains indications for the FG facilitators.

5) The set of pointers under the heading 'Memo for Facilitators' are provided to clarify which dimensions and aspects of an issue are of interest for the research. Lists are not necessarily exhaustive, nor must each point be addressed.

By no means are the pointers to be interpreted as direct questions to be asked. They are to be used as reminders to facilitators for keeping the discussion within the research aims.

2.5.1.2. Short Individual Forms

Prior to the Moderator's introduction to the FG discussion, facilitators collect the written forms containing information about the gender, age, marital status, educational background and income of the FG participants.

Memo for facilitators: ***Please fill out the information below by ticking the appropriate box.***

1. Gender.

Female	
Male	
No answer	

2. Age Group.

25-34	
35-44	
45-54	
55- 65	
No answer	

3. Marital Status.

Single	
Married	
In Civil Partnership	
Divorced	
Widowed	
No answer	

4. Number of Children.

0	
1	
2	
3	
>3	
No answer	

5. Number of People in your Household Including Yourself.

0	
1	
2	
3	
>3	
No answer	

6. Highest Level of Education Attained.

Primary	
Secondary	
Tertiary - Undergraduate	
Tertiary - Postgraduate	
Other	
No answer	

7. Main Source of Income.

No income	
Salary/Pension	
Rental or investment income	
Social welfare	
Other	
No answer	

8. Monthly Range of Income.

< £1000	
£1000-2000	
£2000-3000	
> £3000	
No answer	

2.5.1.3 Stage 1 – Introduction (Duration: 15 minutes)

Introduce yourself. Introduce the project and research theme (see 'Blurb' below). Explain facilitators' role. Explain the purpose of audio recordings: the recordings will only be used by the researcher, and the identity of the participants will not be revealed. The group will be discussing attitudes towards consuming organic olive oil. Explain that participants are free to express their opinions, that their opinions matter, that there are no right or wrong answers, and that this should be enjoyable.

Blurb:

This project is funded by the Syrian Ministry of Higher Education and Damascus University. The purpose of the project is to see the willingness of British consumer behaviour to pay a premium price for organic olive oil in general, and for Syrian organic olive oil specifically.

Introduction by the Moderator

Welcome Sir/ Madam,

Thank you for agreeing to be a part of my focus group.

I am Razan Majar, PhD student at the University of Reading's Department of Food Economics and Marketing. I received a scholarship from the Syrian Ministry of Higher Education to continue my postgraduate research in the UK. My research focuses on the willingness of British consumer behaviour to pay a premium price for organic olive oil in general and for Syrian organic olive oil specifically.

The reason this focus group has been created is to discuss and collect information on various attributes and views that you, the participants, focus on when you are purchasing and using organic olive oil. To aid my research, I would like you to share your true and honest opinions and thoughts through open discussion. This discussion will be very useful because it will allow me to get a better understanding of consumer preferences and inform the design of my survey for wider distribution.

Before we proceed there are some guidelines I would like us to follow:

1) It is important that you do the talking. I would like everyone here to speak and participate.

2) There are no right or wrong answers. Your true opinions, thoughts, experiences and responses are very important to my study. Please feel welcome to join the discussion and share your opinion, whether you agree or disagree with what is being discussed. Hearing different opinions is the main purpose of this focus group.

3) Our discussion will be digitally recorded. This is in order to allow me to have an accurate account of what will be discussed during our meeting and facilitate the subsequent transcription. Your answers will remain anonymous and your identities confidential during all stages of the analysis and presentation of the study's data and results. For this reason, please try to avoid mentioning any of the other participants' surnames.

2.5.1.4 Stage 2 - Warm-up Questions (Duration: 5 minutes)

Icebreaker: Please introduce yourself and share with us something you read, wrote or heard on the TV today!

Today, we are going to talk about your purchasing behaviour of olive oil. Imagine that you are going grocery shopping. Which store do you usually choose to buy olive oil from and why?

(Just to see if the participants are shopping only from one store and looking to one choice or more than one).

What kind of information are you looking for when you are in front of the shelf of olive oil?

Is there any specific information you look for on the product label?

2.5.1.5 Stage 3 - Focus Group Questions (Duration 70 minutes. 20 minutes for each sub-stage)

2.5.1.5.1 The Attributes of Olive Oil (Duration: 20 minutes)

<u>The attitudes of British consumers about organic olive oil</u>

Introduction by the Moderator: I want to shed some light on some concerns which received great attention by consumers regarding the consumption organic olive oil. First, consumers are looking for products which have fewer pesticide residues, are safe and healthier, and are lower in fat etc.

Memo for the facilitators:

1- *What do you think about when you hear the word 'organic'? (To ensure all participants know the benefits of organic produce)*

2- *Have you or any members of your family ever bought organic olive oil? If yes, how often? Is it necessary for the olive oil to be organic or not?*

3- *What are the purposes for the using this product? (To see: for cooking, salad, frying etc).*

4- *Do you think that lifestyle plays an important role in choosing to buy organic olive oil? If so, what are the factors that influence your decision to purchase it (e.g. income, culture, environmental beliefs)?*

5- *Do you think that organic products indicate quality?*

6- *What other important factors do you think would make you choose organic olive oil? (This question to move to another attribute and investigate the shopping habits).*

Types and Grades of Organic Olive Oil

Introduction by the Moderator: We have three types of organic olive oil:

1) First: Extra virgin olive oil has the best olive oil quality because the degree of acidity is less than 0.8 %. It has a superior taste, and usually includes 'premium extra virgin' or 'extra virgin' on the label.

2) Second: Virgin organic olive oil is of good quality, but of lower quality compared to extra virgin. The acidity degree will be less than 2%. This type will be labelled 'fine virgin', 'virgin', and 'semi-fine virgin' on the label.

3) And finally: Standard (or ordinary) organic olive oil is of lower quality, with acidity levels of less than 3.3%. It will be labelled as 'pure olive oil', 'refined olive oil' or 'light'.

Extra virgin and virgin olive oil are made from the first pressing of the olive fruits. No chemical or high heat is used to extract of the olive oil. Pure olive oil is of a lower quality and has less colour and taste, as you can see in this picture:

{Show the participants the label for various types of the product}

Memo for facilitators:

7- *Did you notice the type of oil on the product's label (Extra virgin, virgin, pure etc.)?*

8- *Do you have a better understanding of the different types of organic olive oil?*

9- *Which type do you prefer to use?*

10- *Do you think this attribute catches your attention when you buy organic olive oil?*

11- *Do you think the name of the product indicates its quality?*

Country of Origin

Introduction by the Moderator: The highest production and consumption of olive oil in general is in Mediterranean countries (Greece, Italy, Spain, and Syria). In addition, there are also non-Mediterranean countries with high levels of olive oil production, for instance in America.

We notice different kinds of organic olive oil in the shops with different colours, aromas and flavours, and we can distinguish between them by noticing:

1) Spanish organic olive oil usually has a golden yellow colour with nutty, fruity flavour.
2) Italian organic olive oil often has a dark green colour, strong grassy flavour and herbal aroma.
3) Greek organic olive oil has a green colour and strong flavour.
4) Syrian organic olive oil has a light colour and flavour.

{Show different bottle of organic olive oil with different countries label}

Spanish ***Italian*** ***Greek*** ***Syrian***

Memo for the facilitators:

12- *Which one do you prefer to choose when you buy organic olive oil and why?*

13- *Do you think the country of origin is important when you purchase this product? If so, to what extent?*

14- *Can the country of origin can be considered as indicator for quality or not? (Probe: If so, why? Trust, credence, certification...)*

15- *Why would you select this product based on the country of origin? (Feeling, fact, reputation…)*

Size of the Bottle and the Type of the Bottle

Introduction by the Moderator: Olive oil is sold in different-sized bottles (250 ml, 500 ml, 750 ml) made of different materials such as plastic, glass or metal.

{Show different sizes of the bottles of organic olive oil}

Memo for facilitators:

16- *Which size of bottle do you prefer to use and why?*

17- *Does the shape of the bottle or the packaging material affect your purchase decision? Can you explain why?*

18- *Is there anything else about the shape of the bottle (like the lid of the bottle for example) that affects your decision?*

Colour of Olive Oil

Introduction by the Moderator*:* Let us turn to the appearance of the olive oil. The colours include a pure yellow, green and a yellowish-green.

Show different colours of the product:

Memo for facilitators:

19- *Do you think that the colour of the product affects the quality? Which one do you prefer?*

20- *Do you have any idea about why there are different colours of organic olive oil?*

21- *Do you think the colour of the product is a key factor in selecting it?*

Taste of the Product/ Flavour / Aroma:

Introduction by the Moderator: Different olive oils have different tastes, from bland to fruity. When you taste fruity olive oil you notice the flavour of the fruit (olive) in it. Bland olive oil has lower fruit taste and is mild. You can also find different flavoured organic olive oils such as garlic, basil, pepper, lemon etc.

{Show different flavour of the product}

Memo for facilitators:

22- *Do you prefer to buy organic olive oil with added flavours or without? If so, why?*

23- *What kind of taste do you like and why?*

24- *Do you think this can affect the quality of product?*

25- *Is there any other characteristic of olive oil you would like to add to our discussion?*

2.5.1.5.2 Willingness to pay a price premium for organic olive oil (Duration 20 minutes)

Introduction by the Moderator: We will move on to discuss whether you would be willing to pay more money for organic olive oil. Most of you know that the organic products are more expensive than non-organic ones; this is what we observe in supermarkets and shops. The popular belief is "you get what you pay for". What do you think about this?

Memo for facilitators:

{Show card: willingness to pay for organic olive oil}

I will show two bottles of olive oil (organic and non-organic). Both are the same size, they have the same country of origin, the same flavour and same shape of bottle. The organic one is more expensive than the other. I will then ask the participants:

26- *Which one would you choose and why?*

27- *How much would you be willing to pay for this product?*

28- *Is there any relationship between the price and other attributes which I mentioned to before?*

29- *How do you evaluate the quality of the olive oil? (Prompt: from all the attributes or just from product price?)*

30- *Do they use all the available quality signals? How do they combine them to discover the quality?*

2.5.1.5.3 The Importance of Olive Oil Attributes by Ranking (Duration 20 minutes)

Do the participants continue to use the price as a cue of quality?

Please rank these attributes of olive oil that you might consider when buying organic olive oil (from high important/ 1 to less important/9).

Memo for facilitators: (the table should be on a separate sheet):

Attributes of Olive Oil	**Answer**
County of Origin	
Grade of Olive Oil (Extra Virgin, Virgin, Ordinary)	
Size of the bottle	
Shape of the bottle	
Flavour	
Type of the bottle (tank, plastic, glass)	
Olive Oil Colour	
Price	
Organic/ Non Organic	

2.5.1.6 Stage 4. Feedback & Closing the FG (Duration 5 minutes)

Comments by the Moderator:

31- Do you have any other comment you would like to add to the discussion?

32- The Moderator offers a brief summary of the main ideas and issues discussed during the FG and ask for a few points as a feedback.

33- I would like to thank everyone very much for attending and participating in this FG. Your input and contribution is very valuable for my research.

34- If any participant requires further information about the nature of my project or further clarification on how the collected information will be used in my project, please do not hesitate to contact me or contact my supervisors as detailed below:

Razan Majar.

School of Agriculture, Policy and Development
Dept of Food Economics & Marketing
University of Reading, Earley Gate
Whiteknights, PO Box 237
Reading, United Kingdom
RG6 6AR
E-mail: Razan.Majar@pgr.reading.ac.uk
Tel: +44(0)118 378 5038

Supervisors at Reading University:

1. **Prof Kelvin Balcombe**	2. **Dr C S Srinivasan**
School of Agriculture, Policy and Development Dept of Food Economics & Marketing University of Reading, Earley Gate Whiteknights, PO Box 237 Reading, United Kingdom RG6 6AR E-mail: K.g.balcombe@reading.ac.uk Tel: +44 (0)118 378 8298	School of Agriculture, Policy and Development Dept of Food Economics & Marketing University of Reading, Earley Gate Whiteknights, PO Box 237 Reading, United Kingdom RG6 6AR E-mail: c.s.srinvasan@reading.ac.uk Tel: +44 (0) 118 378 8966

The End of Focus Group Protocol.

By Razan Majar

Appendix Three: Verbal Protocol Analysis

Verbal Protocol Analysis of Consumer Behaviour

University of Reading

School of Agriculture, Policy and Development

Department of Food Economics and Marketing

Verbal Protocol Analysis of Consumer Behaviour

2013

By

Razan Majar

Invitation Letter for Participants

School of Agriculture, Policy and Development
Department of Food Economics and Marketing
University of Reading, Earley Gate
Whiteknights, PO Box 237
Reading, United Kingdom
RG6 6AR
Tel: 0118 378 4549
Fax: 0118 935 2421

Dear Sir/ Madam,

My name is Razan Majar and I am a PhD student at the Department of Food Economics & Marketing at the University of Reading. My research studies in the UK are funded by the Syrian Ministry of High Education. My research focuses on the willingness of British consumers to pay a premium price for organic olive oil in general, and for Syrian organic olive oil specifically.

As part of my research I would like to conduct a number of interviews with willing participants to help me better understand participants' experience, skills, and attitudes when purchasing olive oil for general and specific purposes.

The participants have been selected from Wycliffe Church in Reading. Each interview will last approximately 10-15 minutes. The purpose of the interviews is to explore the various attributes and viewpoints of participants when buying or consuming organic olive oil. Understanding consumer preferences in greater depth will help me to design a survey for wider distribution as part of my research project.

Your name and answers will remain anonymous and your identity will remain confidential during the analysis and presentation of my study's data and results. Your participation is completely voluntary and you are free to withdraw from the interview at any time without providing an explanation.

The interview will be recorded and the recording from your participation will be used for research purposes. It will be stored in a password-protected university computer and one copy will be saved on an external CD as a backup. Only the researcher and the supervisors will have permission to access to my data. All the saved recorders will be destroyed after five years.

This research has been reviewed according to the procedures specified by Reading University Research Ethics Committee and has been accorded ethical clearance. By

participating in this research you are acknowledging that you understand the terms of participation and that you consent to these terms.

The research results and findings will be published in international journals. This will not affect your privacy. I would be happy to answer any further questions you have about the interview and my study. You may contact me by phone or email using the details below.

The date, time and the place of the interview are listed below.

Date	
Time	
Place	

If you are unable to attend for any reason please let me know as soon as possible, alternatively, you can contact one of my supervisors as detailed below. Otherwise, I look forward to seeing you.

Razan Majar

School of Agriculture, Policy and Development
Department of Food Economics & Marketing
University of Reading, Earley Gate
Whiteknights, PO Box 237
Reading, United Kingdom
RG6 6AR
Email: Razan.Majar@pgr.reading.ac.uk
Telephone: 0118 378 5038

Supervisors at Reading University:

1. Prof Kelvin Balcombe	**2. Dr C S Srinivasan**
School of Agriculture, Policy and Development Department of Food Economics & Marketing University of Reading, Earley Gate Whiteknights, PO Box 237 Reading, United Kingdom RG6 6AR E-mail: K.g.balcombe@reading.ac.uk Tel: 0118 378 8298	School of Agriculture, Policy and Development Department of Food Economics & Marketing University of Reading, Earley Gate Whiteknights, PO Box 237 Reading, United Kingdom RG6 6AR E-mail: c.s.srinvasan@reading.ac.uk Tel: 0118 378 8966

Reference Number:

Information Sheet and Consent Form

Study Title: Verbal Protocol Analysis of British Consumers' Willingness to Pay for Organic Olive Oil.

Objective: The objective of this research is to explore the various attributes and viewpoints British consumers focus on when buying or consuming organic olive oil, with the aim of understanding consumer preferences in greater depth.

Description of the Methods: Verbal Protocol Analysis (VPA) is a qualitative evaluation method which provides an ample reflection of the cognitive process of consumer behaviour. VPA can be summarized into two acts: thinking out loud and verbalisation. Used by the participant to find out and test the organic olive oil in order decide during the purchase process. VPA will provide data about the perceptions and preferences of the British consumers in relation to organic olive oil in general and Syrian olive oil in particular.

Selecting the Participants: The participants have been selected from Wycliffe Church in Reading. Each interview will last approximately 10-15 minutes. The sample size is between 8-10 participants both male and female, aged 25-65 years.

Participation and withdrawal: Your participation is completely voluntary; you are free to withdraw from the interview at any time without providing an explanation. Any contribution can be withdrawn at any stage and removed from the research if desired. If you wish to withdraw, please contact me on details below, quoting the reference at the top of this page. The reference will only be used to identify your interview and will not reveal any other information about you.

Confidentiality and security of information: Your name and answers will remain anonymous and your identity will remain confidential during the analysis and presentation of my study's data and results. All the information collected from your interview and all the responses will be used by the supervisors and me, and will not be shared with anybody else.

Recording and saving the data: The protocol will include recorded observations (written, audio, or video recordings). The recorded data will provide information in regards to the ways consumers verbalize their thoughts when talking loudly during the task of purchasing organic olive oil. The recording from your participation will be used for research purposes and it will be stored in a password protected university computer. One copy will be saved on an external CD as a backup copy. Only the researcher and the supervisors will have the permission to access to my data. All the saved recordings will be destroyed after five years.

Consent form: You have been informed of and understand the purposes of my research project and you have the right not to answer any question if you feel uncomfortable.

Research Ethics Committee: This research has been reviewed according to the procedures specified by Reading University Research Ethics Committee and has been accorded ethical clearance. By participating in this study you are acknowledging that you understand the terms of participation and that you consent to these terms.

Contact details of the investigators: The research results and findings will be published in international journals. This will not affect your privacy. I would be happy to answer any further questions you have about the interview and my study. You may contact me using the details below.

Yours faithfully,

Razan Majar

School of Agriculture, Policy and Development
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Supervisors at Reading University:

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An Example of Verbal Protocol

"Hi, my name is Razan, and you are…?" (*Spelling the name to make sure that it is right)*

My aim for today is to try to find out your view on organic olive oil products, and to see through your eyes how you'd select them. First let me familiarize you with the product *(pointing to the organic olive oil section).* What I would like you to do is to think out loud while you are shopping for olive oil products. This will allow me to see how specific products appear to you, using a method called "thinking out loud".

Feel free to talk aloud about what you would do and where you would go in the supermarket (for example whether you would go directly to the organic olive oil section or not). I would like you to verbalize any feelings, experiences, knowledge, needs, and concerns about the product. Whenever you see something as you visualise your journey to the olive oil, please mention it.

You can also talk about the different brands of organic olive oil that you might be purchasing as well as the brands that you do notice but choose not to buy. *For example*, you can talk about your observations in regards to the brands, the product's location in the store, package size, ingredients, flavour, colour, country of origin, type and price.

Remember you have asked to say anything that comes to your mind, even if you think it is unimportant. It might be unimportant to you, but it might be important for the purposes of my research.

When the consumer stops thinking aloud, there are sets of encouraging statements to remind him or her to continue talking aloud:

- What are you doing (or thinking) now?
- Could you please tell me what you see?
- What does this attribute mean to you?
- Can you explain if there are any attributes you are uncertain about?
- Would you like to explain that please?
- Was there anything troubling you when you were choosing this specific product?

I will be recording your observations and thoughts for later analysis in my project. The recording will include the path taken through the store, the section of organic olive oil, your choice of product etc.

End of Verbal Protocol Analysis

Appendix Four: Questionnaire Design

Questionnaire Design

4.1 Block A, includes 32 Questions.

4.2 Section One (I)

4.2.1 Screeners

1. Are you a British resident?

Yes	
No	

2. Do you buy olive oil?

Yes	
No	

3. What is your gender?

Male	
Female	

4.2.2 The information sheet file & Background of olive oil

1. Please click the link below to read the information sheet. (See section 4.8 for hard copy of this information sheet in this Appendix)
   http://www.personal.rdg.ac.uk/~aes05kgb/Information%20Sheet_11_12_2014.pdf
2. Please read the olive oil attributes file below: (See section: 4.9 for Background of Olive Oil in this Appendix).

   http://www.personal.rdg.ac.uk/~aes05kgb/Section%20One%20_Olive%20Oil%20Attributes_11_12_2014.pdf

4.3 Section Two (II): An Example

Below is a typical choice card that you will encounter in Section Three. Each choice card consists of three options. Each option is a combination of a set attributes of olive oil. The level of each attribute can change from one option to another. After carefully reading all of the options in the choice card, you will be asked to indicate your preferred option by ticking one of the boxes next to 'I would like to choose option'.

Please tick **ONE BOX ONLY** which represents your preferred choice, or tick the "I do not know" option.
Note: the Size of olive oil bottle is **500ml** for all prices in all choice cards.
Question to the participant: Please tick the box that represents your preferred option:

Attribute	**Option 1**	**Option 2**	**Option 3**	
Organic	Non-organic	Organic	Non-organic	
Country of Origin	Italian	Spanish	Syrian	
Colour	Green	Dark Green	Yellow	
Packaging	Glass	Plastic	Glass	
Flavour	Fruity	Nutty	Bitter	
Type (Grade) of olive oil	Extra Virgin	Standard	Extra Virgin	
Taste	Smooth	Strong	Smooth	
Fairtrade	Non Fairtrade	Fairtrade	Fairtrade	
Price	£3.16	£5.30	£4.99	
I would like to choose	Option1	Option2	Option3	I do not know
	☐	☐	☐	☐

4.4 Section Three (III)

Here you will be presented with thirteen choice cards and asked to choose your preferred option. Start with the first choice card and please make sure that you provide answers for all the choice cards.

4.4.1 Choice Card 1

Which of these options would you choose? Please tick the box that represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	**Option 1**	**Option 2**	**Option 3**	
Organic	Non-Organic	Organic	Organic	
Country of Origin	Italian	Greek	Spanish	
Colour	Green	Dark Green	Dark Green	
Packaging	Glass	Plastic	Glass	
Flavour	Fruity	Bitter	Nutty	
Type (Grade) of olive oil	Extra Virgin	Light	Standard	
Taste	Smooth	Strong	Strong	
Fairtrade	Non Fairtrade	Non Fairtrade	Fairtrade	
Price	£3.16	£5.30	£6	
I would like to choose	Option 1	Option 2	Option 3	I do not know
	☐	☐	☐	☐

4.4.2 Choice Card 2

Which of these options would you choose? Please tick the box that represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	Option 1	Option 2	Option 3	
Organic	Non-organic	Non-organic	Organic	
Country of Origin	Italian	Syrian	Spanish	
Colour	Green	Dark Green	Dark Green	
Packaging	Glass	Glass	Glass	
Flavour	Fruity	Bitter	Fruity	
Type (Grade) of olive oil	Extra Virgin	Standard	Light	
Taste	Smooth	Strong	Smooth	
Fairtrade	Non Fairtrade	Fairtrade	Fairtrade	
Price	£3.16	£4.99	£2	
I would like to choose	Option 1	Option 2	Option 3	I do not know
	☐	☐	☐	☐

4.4.3 Choice Card 3

Which of these options would you choose? Please tick the box that represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	Option 1	Option 2	Option 3	
Organic	Non-organic	Organic	Organic	
Country of Origin	Italian	Greek	Spanish	
Colour	Green	Dark Green	Dark Green	
Packaging	Glass	Plastic	Glass	
Flavour	Fruity	Bitter	Bitter	
Type (Grade) of olive oil	Extra Virgin	Standard	Standard	
Taste	Smooth	Strong	Strong	
Fairtrade	Non Fairtrade	Fairtrade	Fairtrade	
Price	£3.16	£4.99	£6	
I would like to choose	Option 1	Option 2	Option 3	I do not know
	☐	☐	☐	☐

4.4.4 Choice Card 4

Which of these options would you choose? Please tick the box that represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	Option 1	Option 2	Option 3
Organic	Non-organic	Organic	Non-organic
Country of Origin	Italian	Spanish	Spanish
Colour	Green	Yellow	Green
Packaging	Glass	Plastic	Plastic
Flavour	Fruity	Fruity	Nutty
Type (Grade) of olive oil	Extra Virgin	Standard	Extra Virgin
Taste	Smooth	Strong	Strong
Fairtrade	Non Fairtrade	Fairtrade	Non Fairtrade
Price	£3.16	£6	£6
I would like to choose	Option 1 ☐	Option 2 ☐	Option 3 ☐	I do not know ☐

4.4.5 Choice Card 5

Which of these options would you choose? Please tick the box that represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	Option 1	Option 2	Option 3
Organic	Non-organic	Organic	Organic
Country of Origin	Italian	Syrian	Greek
Colour	Green	Dark Green	Yellow
Packaging	Glass	Glass	Plastic
Flavour	Fruity	Fruity	Bitter
Type (Grade) of olive oil	Extra Virgin	Standard	Extra Virgin
Taste	Smooth	Smooth	Smooth
Fairtrade	Non Fairtrade	Non Fairtrade	Fairtrade
Price	£3.16	£6	£2
I would like to choose	Option 1 ☐	Option 2 ☐	Option 3 ☐	I do not know ☐

4.4.6 Choice Card 6

Which of these options would you choose? Please tick the box that represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	Option 1	Option 2	Option 3	
Organic	Non-organic	Organic	Organic	
Country of Origin	Italian	Syrian	Greek	
Colour	Green	Dark Green	Yellow	
Packaging	Glass	Glass	Plastic	
Flavour	Fruity	Fruity	Bitter	
Type (Grade) of olive oil	Extra Virgin	Standard	Extra Virgin	
Taste	Smooth	Smooth	Smooth	
Fairtrade	Non Fairtrade	Non Fairtrade	Fairtrade	
Price	£3.16	£6	£2	
I would like to choose	Option 1	Option 2	Option 3	I do not know
	☐	☐	☐	☐

4.4.7 Choice Card 7

Which of these options would you choose? Please tick the box that represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	Option 1	Option 2	Option 3	
Organic	Non-organic	Non-Organic	Non-Organic	
Country of Origin	Italian	Italian	Italian	
Colour	Green	Green	Green	
Packaging	Glass	Glass	Glass	
Flavour	Fruity	Fruity	Fruity	
Type (Grade) of olive oil	Extra Virgin	Extra Virgin	Extra Virgin	
Taste	Smooth	Smooth	Smooth	
Fairtrade	Non Fairtrade	Non Fairtrade	Non Fairtrade	
Price	£3.16	£2	£5.30	
I would like to choose	Option 1	Option 2	Option 3	I do not know
	☐	☐	☐	☐

4.4.8 Choice Card 8

Which of these options would you choose? Please tick the box that represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	**Option 1**	**Option 2**	**Option 3**	
Organic	Non-organic	Organic	Organic	
Country of Origin	Italian	Syrian	Syrian	
Colour	Green	Dark Green	Green	
Packaging	Glass	Plastic	Plastic	
Flavour	Fruity	Nutty	Nutty	
Type (Grade) of olive oil	Extra Virgin	Extra Virgin	Light	
Taste	Smooth	Strong	Strong	
Fairtrade	Non Fairtrade	Fairtrade	Fairtrade	
Price	£3.16	£5.30	£6	
I would like to choose	Option 1 ☐	Option 2 ☐	Option 3 ☐	I do not know ☐

4.4.9 Choice Card 9

Which of these options would you choose? Please tick the box that represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	**Option 1**	**Option 2**	**Option 3**	
Organic	Non-organic	Non-Organic	Organic	
Country of Origin	Italian	Greek	Italian	
Colour	Green	Yellow	Green	
Packaging	Glass	Glass	Glass	
Flavour	Fruity	Nutty	Bitter	
Type (Grade) of olive oil	Extra Virgin	Light	Standard	
Taste	Smooth	Strong	Strong	
Fairtrade	Non Fairtrade	Fairtrade	Non Fairtrade	
Price	£3.16	£5.30	£6	
I would like to choose	Option 1 ☐	Option 2 ☐	Option 3 ☐	I do not know ☐

4.4.10 Choice Card 10

Which of these options would you choose? Please tick the box which represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	Option 1	Option 2	Option 3	
Organic	Non-organic	Organic	Organic	
Country of Origin	Italian	Syrian	Spanish	
Colour	Green	Dark Green	Green	
Packaging	Glass	Plastic	Plastic	
Flavour	Fruity	Nutty	Bitter	
Type (Grade) of olive oil	Extra Virgin	Light	Extra Virgin	
Taste	Smooth	Strong	Strong	
Fairtrade	Non Fairtrade	Non Fairtrade	Fairtrade	
Price	£3.16	£2	£4.99	
I would like to choose	Option 1 ☐	Option 2 ☐	Option 3 ☐	I do not know ☐

4.4.11 Choice Card 11

Which of these options would you choose? Please tick the box that represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	Option 1	Option 2	Option 3	
Organic	Non-organic	Non-organic	Organic	
Country of Origin	Italian	Greek	Syrian	
Colour	Green	Yellow	Yellow	
Packaging	Glass	Glass	Glass	
Flavour	Fruity	Nutty	Bitter	
Type (Grade) of olive oil	Extra Virgin	Extra Virgin	Extra Virgin	
Taste	Smooth	Smooth	Smooth	
Fairtrade	Non Fairtrade	Fairtrade	Non Fairtrade	
Price	£3.16	£2	£5.30	
I would like to choose	Option 1 ☐	Option 2 ☐	Option 3 ☐	I do not know ☐

4.4.12 Choice Card 12

Which of these options would you choose? Please tick the box which represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	Option 1	Option 2	Option 3	
Organic	Non-organic	Organic	Non-organic	
Country of Origin	Italian	Spanish	Greek	
Colour	Green	Yellow	Yellow	
Packaging	Glass	Glass	Glass	
Flavour	Fruity	Nutty	Bitter	
Type (Grade) of olive oil	Extra Virgin	Standard	Standard	
Taste	Smooth	Smooth	Strong	
Fairtrade	Non Fairtrade	Fairtrade	Non Fairtrade	
Price	£3.16	£4.99	£2	
I would like to choose	Option 1 ☐	Option 2 ☐	Option 3 ☐	I do not know ☐

4.4.13 Choice Card 13

Which of these options would you choose? Please tick the box which represents your preferred option. Note: The Size of olive oil bottle is 500ml for all prices.

Attribute	Option 1	Option 2	Option 3	
Organic	Non-organic	Non-organic	Non-organic	
Country of Origin	Italian	Spanish	Spanish	
Colour	Green	Yellow	Green	
Packaging	Glass	Plastic	Plastic	
Flavour	Fruity	Nutty	Nutty	
Type (Grade) of olive oil	Extra Virgin	Standard	Light	
Taste	Smooth	Smooth	Strong	
Fairtrade	Non Fairtrade	Fairtrade	Fairtrade	
Price	£3.16	£4.99	£6	
I would like to choose	Option 1 ☐	Option 2 ☐	Option 3 ☐	I do not know ☐

4.5 Section Four (IV)

Please indicate which of the following attributes you did **NOT pay attention to (if any)** when making your choices.

Attributes	**Please, Tick if you ignore**
Organic/ Non-organic	
Country of Origin	
Colour	
Packaging	
Flavour	
Type (Grade) of olive oil	
Taste	
Fairtrade	
Price	

4.6 Section Five

1- Please **RANK** the following attributes in order of their importance when completing the choice tasks in section three. Give each attribute a score from 1 to 9 (where **number one represents highest importance and number nine represents the lowest importance**) No attribute should have the same score as another.

Attributes	1	2	3	4	5	6	7	8	9
Organic/ Non-organic									
Country of Origin									
Colour									
Packaging									
Flavour									
Type (Grade) of olive oil									
Taste									
Fairtrade									
Price									

2- Did you understand the meaning of the attributes? Please tick Yes or No

	Yes	No
1- Do you understand what “organic” means?		
2- Do you understand what “country of origin” means?		
3- Do you understand what “colour” means?		
4- Do you understand what “packaging” means?		
5- Do you understand what “flavour” means?		
6- Do you understand what “type of olive oil” means?		
7- Do you understand what “taste” means?		
8- Do you understand what “Fairtrade” means?		
9- Do you understand what “price” means?		

3- Do you think that higher-priced olive oils are associated with higher quality?

4- What do you mainly use olive oil for?

5- Would you prefer Syrian olive oil over olive oil sourced from others countries? If yes, please briefly explain why? If not, why not?

4.7 Section Six (VI)

Please answer all the following questions: Please mark in the appropriate option.

4.7.1 Gender

Please tick the relevant option:

Female	
Male	
Prefer not to answer	

4.7.2 Age Group (Years)

Please tick the relevant option:

18- 24	
25-34	
35-44	
45-54	
55- 65	
Above 65	
Prefer not to answer	

4.7.3 Marital Status

Please tick the relevant option:

Single	
Married	
In Civil Partnership	
Divorced	
Widowed	
Prefer not to answer	

4.7.4 Number of Children Living in Your Household

Please tick the relevant option:

0	
1	
2	
3	
>3	
Prefer not to answer	

4.7.5 Number of People in Your Household Including Yourself

Please tick the relevant option:

1	
2	
3	
4	
5	
>5	
Prefer not to answer	

4.7.6 Highest Level of Education Attained

Please tick the relevant option:

Primary	
Secondary	
Tertiary – Undergraduate	
Tertiary – Postgraduate	
Other	
Prefer not to answer	

4.7.7 Main Source of Income

Please tick the relevant option:

No income	
Salary/Pension	
Rental or investment income	
Social welfare	
Other	
Prefer not to answer	

4.7.8 Annual Pre -Tax Household Income Range

Please tick the relevant option:

< £10.000	
£ 10,000 - £ 20,000	
£20,000 - £ 40,000	
£40,000 - £ 60.000	
£60,000 - £ 100.000	
> £ 100,000	
Prefer not to answer	

4.8 Information sheet

Study Title: British Consumers' Willingness to Pay for Syrian Organic Olive Oil

Objective: The objective of this research is to understand consumer perceptions and attitudes towards different types of olive oil. Participants will be asked about their attitudes towards olive oil, and will be asked to make hypothetical choices between olive oils with different characteristics.

Description of the questionnaire: This questionnaire consists of six sections. The first section provides background information about organic olive oil and its characteristics, along with a description of the attributes of olive oil that will be used later in the questionnaire. The second section gives an example of the type of choice that participants will need to make in section three. The third section consists of thirteen choice cards where you will be asked to choose your preferred option. Each choice card consists of three options, where each option is a combination of the main attributes that define the nature of the olive oil (including its price). In the fourth section of the questionnaire you will be asked supplementary questions to indicate whether specific attributes were ignored when completing the choice tasks. In section five you will be asked to rank these attributes in terms of importance. Section six asks questions about your gender, age, education and income. This information will be used to establish the representativeness of the sample for the population of interest, and to help in analysing the data.

Participation and withdrawal: You are free to withdraw from answering the questionnaire at any time without giving a reason. You can withdraw your participation any stage and be removed from the research if desired. If you wish to withdraw, please contact me using the details below, quoting the participant reference number at the top of this page. The reference

will only be used to identify your interview and will not reveal any other information about you.

Confidentiality and security of information: Your responses will be treated anonymously and your identity will remain confidential during analysis and in the presentation of the study's results. The data collected from this survey will not be shared with anyone except with the principal researcher and supervisors listed below.

Data Storage: The questionnaire form will be used for research purposes only and it will be stored in a password-protected university computer. One copy will, however, be saved on an external CD as a backup copy. Only the researcher and supervisors will have access to the data. The saved copies will be destroyed after five years. You have been informed of and understand the purposes of this research project, and you have the right to refuse to answer any question if you feel uncomfortable.

Research Ethics Committee: This research has been reviewed according to the procedures specified by Reading University Research Ethics Committee and has been accorded ethical clearance. By participating in this study you are acknowledging that you understand the terms of participation and that you consent to these terms.

Contact details of the investigators: The research results and findings will be published in international journals, which will not affect your anonymity and confidentiality. I would be happy to answer any further questions you have about the questionnaire and my study. You may contact me or my supervisors using the details below:

Razan Majar	**1. Prof Kelvin Balcombe**	**2. Dr C S Srinivasan**
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Dept of Food Economics & Marketing	Dept of Food Economics & Marketing	Dept of Food Economics & Marketing
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4.9 Background of Olive Oil Attributes

In the following table a brief description of olive oil attributes is presented that should help you understand the choice cards later on in the survey. Please read the information carefully and then proceed to section two.

Table: Explanation of olive oil attributes and their corresponding levels.

Attributes	Levels	Explanations
1. Organic	1. Yes 2. No	Certified Organic olive oil is made from 100% organically and naturally grown olives, without any pesticides or chemical fertilizers.
2. Country Of Origin	1. Syria 2. Italy 3. Greece 4. Spain	- Mediterranean countries. - High level of olive oil production.
3. Colour 	1. Yellow 2. Green 3. Dark Green	The appearance of the olive oil, related to the amount of chlorophyll. Olive fruits that are picked early in the season tend to produce green coloured oil.
4. Packaging	1. Glass bottle 2. Plastic bottle	Packaging refers to the way the olive oil is packaged in the bottle.
5. Flavour	1. Fruity 2. Nutty 3. Bitter	Flavour refers to the aroma of olive oil. -**Fruity**: refers to the aroma of fresh olive fruits. When smelled, it is often described with words like 'fruitiness', 'robust', and 'freshness'. -**Nutty**: refers to aroma of almond and is fresh and not oxidized. -**Bitter**: considered a positive attribute because it is indicative of fresh olive fruits. Comes from a mistake in the process of extracting the oil. The amounts of polyphenols determine the bitterness.
6. Type of Olive Oil (Grade).	1. Extra Virgin Olive Oil 2. Standard Olive Oil 3. Light Olive Oil	-The degree of acidity of olive oil **Extra Virgin Olive Oil** has the best olive oil quality. **Standard Olive Oil** is a blend of refined and unrefined olive oil, and is of lower quality compared to extra-virgin. **Light Olive Oil** is a refined olive oil and it is of lower quality compared to extra virgin.
7. Taste	1. Strong 2. Smooth	The taste of olive oil is as an intrinsic cue of the product characteristic. We have two types of taste: **Strong, Smooth**
8. Fairtrade	1. Yes 2. No	Farmers will receive a fair price for Fairtrade products and engage in environmentally friendly practices to produce the olive fruits.
9. Price	1. £2 2. £3.16 3. £4.99 4. £ 5.30 5. £6	The amount of money you pay to buy the product

Source: Focus Group Discussion & Verbal Protocol Analysis, 2013

The End of Block A