

UNIVERSITÀ DEGLI STUDI DELLA TUSCIA DI VITERBO

DIPARTIMENTO DISCIENZE E TECNOLOGIE PER L'AGRICOLTURA, LE FORESTE , LA NATURA E L'ENERGIA (D.A.F.N.E.)

DIPARTIMENTO DI ECONOMIA E IMPRESA (D.E.I.M.)

**Corso di Dottorato di Ricerca in
Economia e Territorio
XXVII Ciclo**

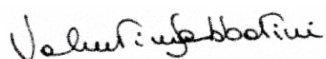
Assessing the value of quality attributes of Italian extra-virgin olive oils:

A hedonic price model

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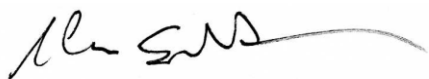
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22.06.2016

Acknowledgements

Special thanks go to my supervisor Prof. Anna Carbone, for her unwavering support and guidance; she advised; encouraged and inspired me to work in this study.

My gratitude and appreciation also go to Prof. Alessandro Sorrentino for giving me the opportunity to pursue my studies and encouraging me with helpful suggestions.

I would like to express my gratitude to Dr. Luca Cacchiarelli and Prof. Tiziana Laureti for providing me their assistance and technical suggestions during my research pursuit.

I would like to thank the staff of the Department for their valuable assistance during the course of my study.

I also would like to thank all the Professors that I met during this significant experience and to those who offered guidance all over the years

Finally, I would also like to thank my parents, my aunt Gabriella and my beloved sister Irene. They were always supporting and encouraging me.

Abstract

Olive oil is one of the food products at the base of the Mediterranean diet. Known since ancient times, it is used as seasoning, and eaten in association with other foods. For the olive oil market, qualitative aspects are emerging recently with an increasing differentiation process. In the last years the concept of quality became more sophisticated, including all those characteristics related to health, quality, safety, hedonism and ethical aspects. Linked to this, a strong international competition requires producers to push on differentiation strategies based on quality. This requires deep knowledge about demand trends on olive oil.

This study focuses on the Italian market as Italy is one of the major and most reputed countries for olive oil production. The research attempts to quantify the influence of different qualitative clues in the creation of value in the Italian extra-virgin olive oil sector. Based on the data gathered from the influential guide “Flos Olei” for three consecutive years, a hedonic price model was built in order to seek the role of different attributes on the final consumer price of extra-virgin olive oil (EVOO). Flos Olei is a leading EVOO guide that reviews the so-called excellence segment of the market giving updated insights on trends and tendencies that will probably extend to other segments of the market over time.

The clues on which the study is focused are gathered in three different groups: the product itself, the olive farm and the processing stage, and the geographical origin. Previous studies based on the application of the hedonic price model for the olive oil market have investigated the effects of only some of these variables within some of the above-mentioned categories. Conversely, in this study a hedonic price model was built including all the main categories of attributes, in order to get more insights about features that impact on the EVOO price. Using the experts’ guide for three consecutive years also made it possible to investigate farm behaviors and advantage, in terms of price premium, by being rewarded from the guide for more than one year. To the best knowledge of the author, none of the previous studies in the application of hedonic price models to the olive oil sector have evaluated either the role of expert judgment or being reviewed for more consecutive years. Furthermore, since in this study, data covers several consecutive years, a panel data

analysis, besides the annual OLS estimations, was also conducted in order to study farm behavior across time, using a fixed effects models and a random one.

The main findings in this study suggest that all of the three different factors are significantly linked to the price. In detail, results indicate that the price of the EVOOs is a reflection of the geographical origin. EVOOs coming from the Northern and the Central part of the country are associated with higher PP compared to those from the Southern part. No univocal indications emerge from the presence of the Geographical Indications of Origin, as well as from the production coming from eco-sustainable farming as well as being a cooperative. The study confirms that consumers are careful not only about the features directly related to the product, but also to those related to the processing stage. The study has demonstrated that products coming from small vertically integrated farms with an onsite mill and following a traditional harvesting process are more valued. Differently, a negative price premium seems to be associated with organic farming. This result contrasts with other studies and may be related to the peculiar market segment (i.e. high to very high prices) to which the guide refers.

The results obtained from the study of the grade given by the experts offer important insights. The consumers seem to be positively sensitive to the farm ranking given by the experts, as a signal of current and long term sensory quality. The positive price premium associated to the presence in more than one year of being connected to a higher grade shows how effective the role of the expert guide is in contributing to the reputation of small farms to become established in wider markets.

Finally, the sensorial category also significantly impacts on the definition of the final price, showing that consumers' tastes are biased towards some kinds of flavors. Actually, the intense flavor is appreciated in EVOOs and is associated with higher price premiums compared to the medium and the light flavorings.

The mono-varietal olive oil seems to be perceived positively, as a recent trend observed in the Italian market and in line with previous works, and can be used, in a sophisticated market, as a tool of promotion for geographical origin based on plant varieties. On the contrary, local varieties are perceived negatively; this is probably because many of them are not known to the majority of consumers. It is worth pointing out that previous results on the price premium associated with mono-varietal EVOO is somehow contrasting with this result, as mono-varietal olive oils are basically produced with local varieties. The last

result worth recalling is related to bottle size: as expected, and in line with previous studies, the smaller the bottle, the higher the price, thus confirming the existence of a clear and strong inverse relation that reflects a higher willingness to pay on the part of consumers for lower quantities, but also a sense of rarity and preciousness associated to small quantities.

Overall the results confirm that the Italian olive oil sector is becoming more sophisticated with different quality clues playing an important role in adding value to the consumers' eyes and with increasing opportunities to segment the market and to elaborate competitive strategies based on different quality conventions.

This research provides a useful tool for producers. Knowledge of the attributes preferred by the consumers suggests the implementation of new marketing strategies to be adopted, in particular for advertising and labeling. In fact, by including some information on the EVOO label, both producers and distributors may raise the added value of their product.

The findings of this study might contribute and give useful insights to the debate on the use of the GI systems. The European certification system (PDO and PGI quality scheme) associated with non-significant coefficients suggests that geographical and varietal diversity can be promoted more by the use of the GI system. In addition it would be appropriate to encourage promotion and information campaigns aimed at highlighting the characteristics of each area, to promote the image of excellence in the olive oil sector.

Keywords: hedonic price modeling, extra-virgin olive oil, Italian olive oil sector, quality attributes, olive oil expert guide evaluation, panel data analysis.

Abstract (Italian version)

L'olio di oliva rappresenta uno degli alimenti alla base della dieta Mediterranea. Conosciuto fin dall'antichità, viene utilizzato come condimento, in accompagnamento ad altri alimenti. Per il mercato dell'olio di oliva, gli aspetti qualitativi stanno emergendo recentemente, con un forte processo di differenziazione. Negli ultimi decenni, il concetto di qualità è diventato più sofisticato, includendo tutte quelle caratteristiche legate alla salute, alla sicurezza, agli aspetti etici ed edonistici. Collegato a questo fenomeno, una forte competizione a livello internazionale, richiede ai produttori di focalizzarsi su strategie di differenziazione basate sulla qualità. Ciò necessita di una profonda conoscenza delle tendenze della domanda per l'olio d'oliva.

Il presente lavoro pone l'attenzione al mercato italiano, visto che l'Italia è uno dei maggiori e più rinomati Paesi per la produzione di olio di oliva. La ricerca ha l'obiettivo di quantificare l'influenza di diversi attributi qualitativi nella creazione di valore per l'olio extra vergine d'oliva italiano.

Sulla base dei dati raccolti dall'influente guida "Flos Olei", per tre anni consecutivi, è stato costruito un modello di prezzo edonico al fine di investigare il ruolo di diversi attributi sul prezzo finale per i consumatori di olio extravergine di oliva (EVOO). Flos Olei è una guida leader nell'ambito degli oli extra-vergine ed include il cosiddetto segmento di eccellenza del mercato, dando una conoscenza aggiornata delle tendenze che probabilmente si estenderanno ad altri segmenti del mercato nel corso del tempo.

Gli attributi, sui quali lo studio si concentra, si riferiscono a tre diversi ambiti: il prodotto in quanto tale, l'azienda e le diverse fasi di lavorazione, la provenienza geografica. Precedenti studi nell'applicazione del modello di prezzo edonico al mercato dell'olio d'oliva hanno studiato gli effetti soltanto di alcuni attributi inclusi nelle categorie sopramenzionate. Al contrario, in questo studio, è stato costruito un modello prezzo edonico comprendendo tutte le principali categorie di attributi, in modo da avere una migliore valutazione della loro importanza nella formazione del prezzo dell'olio extra-

vergine di oliva. Utilizzando la menzionata guida degli esperti per tre anni consecutivi, è stato anche possibile indagare i comportamenti delle aziende ed il vantaggio, in termini di premio di prezzo, di essere recensiti per più anni. A conoscenza dell'autore, nessuno degli studi precedenti nell'applicazione dei modelli di prezzo edonico per il settore dell'olio d'oliva ha valutato sia il ruolo del giudizio di esperti che la presenza nella stessa guida per più anni consecutivi. Inoltre, poiché in questo studio, i dati si riferiscono a più anni, oltre alle stime annuali di tipo OLS, è stato anche condotta un'analisi con dati panel, al fine di studiare il comportamento di tali aziende nel tempo, utilizzando due tipi di regressione per dati panel: ad effetti fissi e variabili.

I risultati ottenuti in questo lavoro suggeriscono che tutte e tre i diversi gruppi di attributi sono significativamente legati al prezzo. Più in dettaglio, i risultati hanno indicato che il prezzo dell'olio extra-vergine di oliva, è strettamente legato alla provenienza geografica. Gli oli provenienti dal Nord e dal Centro Italia sono associati con più alti premi di prezzo rispetto a quelli prodotti nel Sud. Risultati non significativi emergono per la presenza delle Indicazioni Geografiche (DOP e IGP), nonché per le produzioni eco-sostenibili e per le cooperative.

Lo studio ha confermato che i consumatori sono attenti non solo a tutte quelle caratteristiche direttamente legate al prodotto, ma anche a quelle relative alla fase di lavorazione. Lo studio ha dimostrato che i prodotti provenienti da piccole aziende agricole, integrate verticalmente, con olive raccolte con metodi tradizionali e molite in frantoio aziendale sono più apprezzati. Diversamente, un premio di prezzo negativo sembra essere associato alla coltivazione biologica. Questo risultato contrasta con altri studi e può essere correlato al particolare segmento di mercato analizzato (cioè quello ad alti prezzi) a cui la guida si indirizza.

I risultati ottenuti dallo studio del giudizio degli esperti offrono interessanti conclusioni. I consumatori sembrano essere positivamente sensibili al giudizio aziendale assegnato dagli esperti, visto come segnale di qualità a breve ed a lungo termine. Il premio di prezzo positivo associato alla presenza in più anni, collegato ad un elevato punteggio assegnato, dimostra quanto sia efficace il ruolo delle guide redatte da esperti nel contribuire alla reputazione di piccole aziende in più ampi mercati.

Importanti infine, per la definizione del prezzo finale, sono anche le caratteristiche sensoriali, dimostrando che i gusti dei consumatori sono polarizzati verso sapori particolari. Nel dettaglio, il sapore intenso è una caratteristica apprezzata per l'olio di oliva ed è associato a premi di prezzo più elevati rispetto a sapori medio-leggeri.

L'olio mono- monovarietale sembra essere percepito in modo positivo, confermando una recente tendenza osservata nel mercato italiano ed in linea con lavori recenti di settore e può essere utilizzato in un mercato sofisticato, come strumento di promozione della provenienza geografica basata sulla qualità. Al contrario, le varietà locali sono percepite negativamente. Probabilmente perché molte varietà locali non sono note alla maggioranza dei consumatori. Vale la pena di richiamare il risultato precedente sul premio di prezzo associato agli oli monovarietali che in qualche modo contrasta con quest'ultimo risultato, anche se solitamente gli oli d'oliva mono varietali sono prodotti con varietà locali.

L'ultimo risultato che vale la pena ricordare è quello relativo alla dimensione della bottiglia: come previsto, ed in linea con studi precedenti, più piccola è la bottiglia, più alto è il prezzo, confermando così l'esistenza di una chiara e forte relazione inversa che riflette una maggiore disponibilità a pagare dei consumatori, ma anche un senso di rarità e preziosità associata a piccole quantità.

Nel complesso i risultati confermano che il settore dell'olio d'oliva italiano sta diventando sempre più sofisticato rispetto al passato, con diversi attributi qualitativi che giocano un ruolo importante nel creare valore aggiunto agli occhi dei consumatori e con un aumento della possibilità di segmentare il mercato e di elaborare strategie competitive in base a convenzioni di qualità diverse.

Questa ricerca fornisce un utile strumento per i produttori. Infatti, la conoscenza degli attributi qualitativi preferiti dai consumatori, suggerisce l'implementazione di nuove strategie di marketing da adottare, in particolare nell'ambito della pubblicità e dell'etichettatura. In dettaglio, indicando alcune informazioni sull'etichetta degli oli, per i produttori e distributori sarà possibile dare un valore aggiunto al loro prodotto.

I risultati di questo studio potrebbero contribuire e dare indicazioni utili al dibattito dell'uso del sistema delle Indicazioni Geografiche. Il sistema di certificazione europeo (DOP ed IGP) associato a coefficienti non significativi suggerisce che la diversità geografica e

varietale può essere promossa maggiormente dall'utilizzo del sistema delle IG. Inoltre, sarebbe opportuno incoraggiare campagne di promozione e di informazione volte a evidenziare le caratteristiche di ogni zona e promuovere l'immagine delle eccellenze del settore dell'olio d'oliva.

Parole chiave: modello di prezzo edonico, olio extravergine d'oliva, settore dell'olio d'oliva italiano, attributi di qualità, valutazione da parte di esperti per l'olio extra-vergine di oliva, analisi di dati di tipo panel.

Table of Contents

Acknowledgements	ii
Abstract.....	iii
Abstract (Italian version)	vi
I. Executive summary	1
I.1 Contextual setting.....	1
I.2 Literature review	4
I.3 Materials and methods	8
I.4 Hedonic price model: empirical applications	10
I.5 Concluding remarks and further extensions.....	12
INTRODUCTION AND RESEARCH QUESTIONS	14
CHAPTER 1: Contextual setting.....	16
1.1 The world olive oil market	16
1.2 The Italian oil sector.....	20
1.2.1 The Italian GI extra-Virgin olive oil sector	26
1.2.2 The Italian olive oil organic farming.....	29
CHAPTER 2: LITERATURE REVIEW	31
2.1 The role of quality in the agricultural sector.....	31
2.2 Role of quality and information in a differentiated market	32
2.3 The assessment of the qualitative attributes in the olive oil market.....	36
2.4 The hedonic price model.....	52
CHAPTER 3: MATERIALS AND METHODS.....	58
3.1 Definition and estimation of hedonic pricing models.....	58
3.2 The hedonic price functional form	60
3.3 Panel data analysis: fixed and random effects model.....	63
3.3.1 Fixed effects model.....	65
3.3.2 Random effects model.....	66
3.4 Target and sample population.....	68
3.5 FLOS OLEI selected variables	78
3.5.1 Prices.....	82
3.5.2 Attributes related to the product.....	86

3.5.3	Attributes related to the farm and production process	95
3.5.4	Attributes related to the geographical origin.....	113
CHAPTER 4: RESULTS.....		119
4.1	The quality variables and their role in the model	119
4.2	Descriptive statistics for panel data analysis	122
4.3	Results of the estimations of the hedonic price model.....	125
4.3.1	Attributes related to the product.....	133
4.3.2	Attributes related to the farm and production process	134
4.3.3	Attributes related to the geographic origin	138
4.3.4	EVOO: a comparison between Italian guides.....	140
CHAPTER 5: CONCLUDING REMARKS		145
References.....		153
Appendix A Original estimated results.....		166

List of Figures

Figure 1 World production of olive oil. Author's elaboration. Source: IOOC, accessed February 2016.....	17
Figure 2 World production of virgin olive oil. Author's elaboration. Source FAOSTAT, accessed 02 September 2015	17
Figure 3 World olive oil consumption 2009-2015 . Author's elaboration. Source: IOOC, accessed February 2016	19
Figure 4 World exports of virgin olive oil. Author's elaboration. Source: FAOSTAT, accessed December 2015.....	20
Figure 5 Italian production of olive oil. Author's elaboration. Source: IOOC, accessed February 2016.....	21
Figure 6 Italian production of virgin olive oil. Source: FAOSTAT, accessed February 2016	22
Figure 7. Italian imports and exports of olive oil. Source: IOOC, accessed February 2016	23
Figure 8. Italian imports and exports of virgin olive oil Source FAOSTAT, accessed February 2016	23
Figure 9. Average regional yield of olive oil Author's elaboration. Source: INEA, accessed October 2015...	25
Figure 10. Numbers of olive oil farms per macro area. Author's elaboration. Source ISTAT , accessed January 2016.....	26
Figure 11. Certified production Certified EVOO. Author's elaboration. Source: Ismea -Qualivita (2012-2013-2014-2015).....	27
Figure 12. Regional prices 2012. Author's elaboration. Source: Unaprol (2012).....	29
Figure 13: Designations and definitions of olive oils . Source: IOOC Retrieved from: <i>http://www.internationaloliveoil.org/estaticos/view/83-designations-and-definitions-of-olive-oils</i>	38
Figure 14. Example of farm and olive oil review, with the symbols used. Source: FLOS OLEI 2015 (2014)	71
Figure 15. Percentage of farms from the Northern part of Italy. Author's elaboration. Source: FLOS OLEI	73
Figure 16. Percentage of farms from the Central part of Italy. Author's elaboration. Source: FLOS OLEI...	74
Figure 17. Percentage of farms from the Southern part of Italy. Authors elaboration. Source: FLOS OLEI..	74
Figure 18. Farm size categories. Author's elaboration. Source: FLOS OLEI	75
Figure 19: Spearman's correlation. Author's elaboration.....	79
Figure 20. Price range in relation to bottle size of 1 liter. Author's elaboration. Source: FLOS OLEI.....	82
Figure 21. Annual prices of EVOOs: €/ Liter. Author's elaboration. Source: FLOS OLEI.....	83
Figure 22: Prices of EVOO: €/Liter per macro-area. Author's elaboration. Source: FLOS OLEI.....	83
Figure 23. Average Prices of EVOOs: €/ Lt for Northern Italy. Author's elaboration. Source: FLOS OLEI.	84
Figure 24. Average Prices of EVOOs: €/ Lt Central Italy. Author's elaboration. Source: FLOS OLEI	84
Figure 25. Average Prices of EVOOs: €/ Lt Southern Italy. Author's elaboration. Source: FLOS OLEI	85
Figure 26:EVOO with an excellent quality price ratio per macro area. Author's elaboration. Source: FLOS OLEI	86
Figure 27:Tasting category for the analyzed EVOOs. Author's elaboration. Source: FLOS OLEI.....	87
Figure 28:Tasting category per macro area. Author's elaboration. Source: FLOS OLEI	88

Figure 29: Number of varieties per EVOO. Author's elaboration. Source: FLOS OLEI.....	89
Figure 30: Number of varieties per EVOO per macro area. Author's elaboration. Source: FLOS OLEI	90
Figure 31: Tasting category per mono-varietal EVOOs Author's elaboration. Source: FLOS OLEI	90
Figure 32: Geographical distribution of varieties per mono-varietal EVOO Author's elaboration. Source: FLOS OLEI	91
Figure 33: Number of varieties per Geographical Indication. Author's elaboration. Source: FLOS OLEI	91
Figure 34: Presence of national-level varieties per macro area. Author's elaboration. Source: FLOS OLEI ..	92
Figure 35: Distribution of national-level varieties per macro-area. Author's elaboration. Source: FLOS OLEI	93
Figure 36: Distribution of national-level varieties in Northern Italy. Author's elaboration. Source: FLOS OLEI	93
Figure 37: Distribution of national-level varieties in Central Italy. Author's elaboration. Source: FLOS OLEI	94
Figure 38: Distribution of national-level varieties in Southern Italy. Author's elaboration. Source: FLOS OLEI	94
Figure 39: Bottle size per EVOO. Author's elaboration. Source: FLOS OLEI.....	95
Figure 40: Presence of cooperative in the dataset. Author's elaboration. Source: FLOS OLEI.....	96
Figure 41: Production of olive oil in hectoliters per farm. Author's elaboration. Source: FLOS OLEI.....	97
Figure 42: Presence of farm mill per production of oil in hectoliters. Author's elaboration. Source: FLOS OLEI	98
Figure 43: Yield of olives per hectare. Author's elaboration. Source: FLOS OLEI	99
Figure 44: Presence of farm mill per production of olives (quintals). Author's elaboration. Source: FLOS OLEI	99
Figure 45: Yield of olives per tree per macro-area Author's elaboration. Source: FLOS OLEI	100
Figure 46: Yield of olives per tree. Author's elaboration. Source: FLOS OLEI	101
Figure 47: Average size per farm that buys olives for processing. Author's elaboration. Source: FLOS OLEI	102
Figure 48: Harvesting method per macro area. Author's elaboration. Source: FLOS OLEI.....	103
Figure 49: Harvesting method per farm size. Author's elaboration. Source: FLOS OLEI.....	103
Figure 50: National varieties per harvesting method. Author's elaboration. Source: FLOS OLEI	105
Figure 51: Presence of farm mill per farm size. Author's elaboration. Source: FLOS OLEI.....	106
Figure 52: Presence of farm mill per production of oil in hectoliters. Author's elaboration. Source: FLOS OLEI	106
Figure 53: Presence of farm mill per production of olives (quintals). Author's elaboration. Source: FLOS OLEI	107
Figure 54: Presence of farm mill per foundation year. Author's elaboration. Source: FLOS OLEI	107
Figure 55: EVOOs from organic farms. Author's elaboration. Source: FLOS OLEI	108
Figure 56: Size of organic farm. Author's elaboration. Source: FLOS OLEI	109
Figure 57: Farm ranking per organic farm. Author's elaboration. Source: FLOS OLEI.....	109

Figure 58: Tasting category per EVOO from organic farm.....	110
Figure 59: Farm ranking. Author's elaboration. Source: FLOS OLEI	111
Figure 60: Farm ranking per foundation year. Author's elaboration. Source: FLOS OLEI	111
Figure 61: Farm ranking per "Eco-sustainability Award". Author's elaboration. Source: FLOS OLEI	112
Figure 62: Farm ranking per "Made with Love" award. Author's elaboration. Source: FLOS OLEI.....	113
Figure 63: Farm size per macro area. Author's elaboration. Source: FLOS OLEI	114
Figure 64. Geographical Indications per macro-area. Author's elaboration. Source: FLOS OLEI.....	115
Figure 65: Denomination of origin per foundation year. Author's elaboration. Source: FLOS OLEI	116
Figure 66: Tasting category per denomination of origin. Author's elaboration. Source: FLOS OLEI	117
Figure 67: Denomination of origin per farm ranking. Author's elaboration. Source: FLOS OLEI	117
Figure 68: Denomination of origin per yield of olives per tree. Author's elaboration. Source: FLOS OLEI	118
Figure 69: Estimated coefficient related to the product attributes. Source: Author's elaboration.....	133
Figure 70: Estimated coefficient related to the farm and production process attributes. Source: Author's elaboration.	135
Figure 71. Estimated coefficient related to the farm and production process attributes. Source: Author's elaboration.	138
Figure 72. Estimated coefficient related to the geographical origin attributes. Source: Author's elaboration.	138

List of Tables

Table 1. Variable description: Price and product attributes.....	80
Table 2. Variable description: Farm and production process attributes	81
Table 3: Variable description: Geographical Origin.....	81
Table 4.2-a: Descriptive statistics panel data: Product attributes	122
Table 4.2-b Descriptive statistics panel data: Farm and production process attributes	123
Table 4.2-c Descriptive statistics panel data: Geographical origin attributes	124
Table 4.3-a. Ramsey RESET test	126
Table 4.3-b. The regression model: Product attributes	127
Table 4.3-c. The regression model: Farm and processing attributes	128
Table 4.3-d. The regression model: Geographical origin attributes	129
Table 4.3-e. The regression model: Post estimations results	129
Table 4.3-f. Breusch and Pagan Lagrangian multiplier	130
Table 4.3-g. Hausman Specification test	130
Table 4.3-i. Hausman specification test: differences among the Fixed and the Random effects model.....	131
Table 4.3-j Descriptive statistics for the two studies	140

I. EXECUTIVE SUMMARY

I.1 Contextual setting

Extra virgin olive oil (EVOO) is a natural juice of the highest quality olives. EVOO is one of the most important elements of the Mediterranean diet and it has exceptional sensory and nutritional properties that provide a high economic value. Known since ancient times, this product has sacred characters attributed to it.

The production of olive oil is concentrated in the Mediterranean basin. On average Europe produces about two thirds of the worldwide production. Spain is the main olive oil and olive producer (1.8 million tonnes in the 2013/14 production season). Italy is the second European producer of olive oil with a share of the total European production at about 19%. Greece is the third largest producer (on average 350 thousand tonnes for the past five years, of which 82% is extra virgin).

The free market orientation and the extension of the production boundaries, not only related to the Mediterranean basin, cause stronger competition. Outside the European borders, olive oil is produced in other Mediterranean countries such as North Africa, Turkey, Syria and in minor quantities in the American Continent and Australia.

The world production of olive oil and virgin olive oil increased over the years, in order to meet the increasing international demand.

The main producer countries of the Mediterranean basin represent the traditional consumers of olive oil. The three main European olive oil producers are, at the same time, the major consumers, absorbing almost half the total world consumption: Italy has a share of 22%¹ of the total world olive oil consumption, followed by Spain 19% and Greece 7%.

However, the consumption of olive oil is spreading to non-traditional areas of the world, through factors such as nutritional features, health claims, promotional campaigns and migration from European countries. The main consumer outside Europe is the US (10% of

¹Italy represents the first European consumer of olive oil, with a percentage consumption in the last five years of about 35% (609 thousand of tonnes).

the world consumption, with an average annual consumption per capita of 1kg²) (Mylonas, 2015), with an increasing demand. Benefitting from the increased US demand in 2011, Spain remains in first place as supplier, before Italy and Greece. A market with a high potential for EU olive oil production is China where olive oil could represent in the next years a luxury good for Chinese consumers who have increased their consumption of olive oil by 69% since 2008. In the last five years, China represented 2% of the world consumption.

In Italy, olive oil production represents one of the major activities in the agricultural sectors, both in terms of income generated and employment as well as in terms of image and reputation. In order to underline the importance of the production of olive oil in the country, it is worth noting that Italy has the highest number of olive varieties (more than 500 are counted). The production of oil and olives is present throughout the Italian territory, including the islands.

In the last decade a turn to a more qualitative production has been promoted for the Italian olive oil sector. About two-thirds of Italian olive production are represented by extra virgin olive oil.

At the European level, Italy is the first importer (78% share of the total European imports). Italy buys from North Africa (Morocco and Tunisia), but also from other European countries (Spain³ and Greece). The big manufacturing companies in Italy buy bulk olive oil in order to blend it, and for branded product processing for the industrial and final market, both domestic and international. According to Mylonas (2015), these companies are able to dominate the market due to the combination of different strategies strongly associated with the country's reputation, brand name, and at the same time, large quantities.

The Italian olive oil heritage is estimated at 150 million olive trees for a total area of 1,165,458 hectares (ISTAT, 2016). Olive cultivation is present in eighteen regions out of twenty (excluding Valle d'Aosta and Piedmont).

The Italian olive oil farms are small (about 3 ha) (ISTAT, 2016) and most of them are family run. The olive area in Italy is fragmented and anchored to the tradition, especially in Southern Italy.

² Spain, Italy and Greece have an annual average consumption per capita of about 10-12 kilograms).

³Spain is the first supplier with a share of the total annual Italian imports of EVOO of about 65%.

The production of olive oil is a priority of Southern Italy. In terms of quantities produced (INEA, 2015), considering the last decade (from 2000 to 2013), the main producers of olive oil are represented by Calabria, Puglia, Sicilia and Campania with a share of 35%, 32% , 9% and 7% respectively, equal to an average of 453.000 tonnes. Regions such as Abruzzi, Lazio, Tuscany, and Umbria from the Central part of the Country have a share of the total production at about 12%, whereas regions from the North have a share of less than 1%, while a residual portion is associated to other regions from the Central and Southern part of the Country.

Recently there has been great interest to retrain the Italian olive oil sector, promoting the history and traditions of the local contexts from which they are derived.

Italy has the most Protected Denominations of Origin (PDO) and Protected Geographic Indications (PGI) than any other EU olive oil producing country (Sabbatini et al, 2016b). In particular, 42 PDO and 1PGI (Toscana) are counted, and represent about 40% of protected European olive oil.

Even if Italy has the highest numbers of EVOO GI recognitions; the whole certified production counts only for 10,919 tons (Ismea- Qualivita, 2013), counting for less than 2% of the total Italian olive oil production. Of these, an impressive 34% comes from the Terra di Bari PDO, and 27% from Tuscany (Olio Toscano PGI).

The PDO and PGI EVOOs represent the highest level of quality, and although they still express a limited percentage of the average consumption, they manage to obtain recognition in price premium compared to common extra-virgin olive oil, of about 54% (Ismea, 2016).

Recently, the Italian organic olive oil sector has increased in terms of farms and cultivated areas. Due to its biological characteristics the olive crop is relatively easy to convert to organic farming as it does not require specific additional investments or other inputs. Based on recent data offered by SINAB (2016), 13% of the organic crop areas are dedicated to olive growing. The area dedicated to organic olive growing has increased since 2009 to about 21%. From the little available information from the commercial front, the organic olive oil market looks very promising in terms of production and prices. Just

consider that the prices of the organic EVOO production, according to ISMEA (2016), exceed by more than 25% higher the conventionally produced extra virgin olive oil.

1.2 Literature review

The demand for food products grows with new needs expressed by consumers (Fotopoulos et al., 2009). In this regard the concept of quality includes different meanings. Quality binds more and more to the ability of a product to meet the complex needs of each consumer, ensuring the capture and maintenance of a market segment. Combined with a growing interest in well-being aspects, this has contributed to increasing the interest in high-quality products. Alongside all those attributes that only relate to the product, attention is also paid to all aspects related to the production process (such as environmental protection, lack of sophistication, organic farming).

The evolution of the demand for agricultural products offers many opportunities to the Italian agro-food system. Italian traditions are renowned and appreciated even outside the national borders. The richness and variety of the heritage linked to food, however, is not fully exploited. The increasing attention to those aspects related to food safety issues has brought better organization of production chains to ensure product traceability. This represents a strong incentive for producers, especially the small ones that characterize the Italian food sector, to organize themselves in order to sell the product.

For the olive oil market, qualitative aspects are emerging recently with a strong differentiation process. Olive oil is a condiment basically used as a seasoning in association to other food. In the last decades the concept of quality became more sophisticated, including all those characteristics related to the health, quality, safety, hedonism and ethical aspects.

For this reason it is important to understand in terms of differentiation strategy which qualitative variables are able to affect the decision of the final consumers and consequently the value associated to each attribute. In light of the considerations, knowledge about how the qualitative cues are evaluated by the final consumers becomes more and more important in order to increase the added value of EVOO, and to differentiate the product with respect to the competitors.

Olive oil for its own characteristics has important credence and experience attributes. So the choice of the purchase by the final consumers is based on several quality clues and for some of them the quality cannot be ascertained before the purchase. For example, for the consumers it is not possible to verify all the processes that lead to the final product or the sensorial traits that characterize the olive oil. Linked to the characteristics of the product such as the nutritional and organoleptic characteristics, a growing attention to those features is observed related to the process such as respect for the environmental and tradition, authenticity and lack of sophistication. In this perspective the concept of quality cannot be referred to a single aspect, but different facets have to be considered.

As pointed out by Cabrera et al. (2015), usually consumers (Fotopoulos and Krystallis, 2001; Sottomayor et al., 2010), especially from non-producer countries (Matthäus and Spener, 2008), are not aware of fundamental distinctions. This leads to being misled concerning olive oil, where major quality features are not easy to assess. In fact, extra virgin olive oil (EVOO) is a natural juice of the highest quality olives obtained exclusively by mechanical and physical processes at low temperatures. EVOO is one of the most important elements of the Mediterranean diet and it has exceptional sensory and nutritional properties that provide a high value, in comparison to the other categories.

Despite the fact that olive oil is a differentiated product for its own characteristics it is not easy to define which characteristics are able to have an influence on the price. Following the consumer approach theory, the main characteristics devoted to influencing the preferences of the consumers can be related to the intrinsic or extrinsic sphere. This distinction is based on the evaluation of the product. The intrinsic characteristics are those related to the product itself, such as the olive variety, the colour, the place of origin, and the producer name, while the extrinsic ones refer to the features not directly related to the product, but that can be able to influence the preferences (Orrego et al, 2012), such as the expert grade.

In a differentiated market, characterized by asymmetric information, a crucial role of guidance and a signal of quality is represented by the experts' rating. In fact olive oil, as previously mentioned, has both search and experience features. The guide represents a tool

for reducing the asymmetry of information between consumers and producers. So a third party can assure the quality of the product and help the consumers in collecting information about the good. Despite the importance of a third expert party with the role of guidance and its importance in the case of olive oil, few studies were concentrated in this issue. The role played by experts' rating was only recently considered as a variable able to influence the price of EVOO (Cicia et.al, 2013).

As argued by Erraach et al. (2014), the European Union in the last years has introduced some tools in order to promote the food differentiation, but at the same time the quality of the attributes of the product, and to preserve the heritage culinary traits. In this way it is possible at the same time to offer high quality goods and reduce the asymmetric information (Menapace et al., 2011) between producers and consumers, transforming the credence and experience features to a search one. The main role of the establishment of standards and labels is to provide information to final consumers linked to the certification, that in this way acts as a credible signal of quality.

A way to overpass the problem of absence of rule in a cooperation can be represented by the Geographic Indications system (GI) represented by the Protected Denomination of Origin (PDO) and the Protected Geographic Indication (PGI) (EC Regulation 509/06) . In an asymmetric market, with non- homogeneous products, the presence of the indications of origin can represent a tool of vertical differentiation of one product from another in terms of quality, through the preservation of the food heritage and the local culinary traits.

Many authors have concentrated attention on the role played by reputation in terms of perceived quality related to the place of origin. The relation between food product, heritage and place of origin has been known since the past. As evidenced by some authors such as Easingwood et al. (2011), the region creates a combination of characteristics that make a product unique.

For its own characteristic, olive oil is particularly suited to the investigation regarding the influence of different factors on olive oil price and how the quality is evaluated by consumers.

The literature on the factors that affect olive oil price is quiet vast. Traditionally attention was concentrated on the consumer side and willingness to pay (WTP).

In the past, different methodological approaches have tried to study the preferences among consumers employing discrete choice models (Caracciolo et al., 2013), with particular attention to Conjoint Analysis and the Random Utility Model, in order to detect which features are more important for the consumers (Del Giudice et al., 2015). Other important studies in this field used experimental analysis (Delgado & Guinard, 2011), multi-criteria analysis (Sandalidou et al., 2002) or analysis based on the study of the sensory profiles of the olive oil (Caporale et al., 2006; Delgado & Guinard, 2011). Recently, there has been a growing interest in the study of the attributes liable to influence the oil price with the use of the hedonic price method (Karipis et al., 2005; Cicia et al., 2013; Carlucci et al., 2014; Cabrera et al., 2015; Romo Munoz et al., 2015; Cacchiarelli et al., 2015b).

The theoretical development of the hedonic price model is based on the work of Rosen (1974), who is recognized as the pioneer of the application of this model. Following the Lancaster approach, Rosen reneges the concept of “divisibility” of the product (Tirole, 1988). So, the price of a product is not the result of a simple addition of each characteristic, but the product can be ideally decomposed into its characteristics, and a market value can be attributed to those features, since the price is a function of different and measurable attributes. In fact, while the product is differentiated, it is difficult to understand the demand and supply conditions only by observing the price in the market.

The first raw application in the agricultural market was proposed by Waugh in 1928 for asparagus, with the aim to discover which attributes consumers appreciate more, and transmit this information to the producers. Then Rosen, in 1974, demonstrated that in market equilibrium, an implicit or shadow price can be associated to the features related to the product.

Recently this method has been largely used for food products like wine (Bicknell et al., 2005; Benfratello et al., 2009; Roma et al., 2013; Cacchiarelli et al., 2014; Cicia et al., 2013; Costanigro et al., 2010), coffee (Teuber & Herrmann, 2012), eggs (Karipidis, Tsakiridou, Tabakis, & Mattas, 2003), and cheese (Schröck, 2014).

Despite the importance of the olive oil sector in the agricultural market, in terms of production and exportation, few studies have been conducted applying the hedonic price model to the Italian EVOOs.

In fact, the olive oil market is getting more diversified and the product is losing its connotation of a commodity and basic everyday life condiment. The process is also pushed by the increase in the international trade of olive oil, with consumers from non-traditionally producing/consuming countries that are increasingly interested in this product and in some cases consider it, to some extent, as a hedonic or even as a *luxury good*.

1.3 Materials and methods

In order to understand the role of different quality clues in the price formation of EVOO, a hedonic price model was built where the price of a bottle of oil is regressed on different quality clues (Rosen, 1974; Thrane, 2004).

Specifically, the following equation was employed:

$$\text{Log } P = \alpha_0 + \alpha_1 \text{Pro} + \alpha_2 \text{Farm} + \alpha_3 \text{Ar} \quad (1)$$

These are grouped in three categories: A) attributes related to the product itself; B) farm and production process features; C) features related to the geographical origin and its certification. A comprehensive list of the variables considered is as follows. The first group includes the following variables: bottle size, tasting category, olive tree varieties, mono-varietal olive oil. In the second are included all those features related to the farm and the production process such as the type of farm (cooperative or not), the average annual farm olive oil production, whether the farm has its own mill, the kind of harvesting method, whether production is organic or conventional, percentage of olives bought outside the farm. Whether EVOO is rewarded with an eco-sustainability award or a “Farm ranking” given by the experts are also included in this variable group. In addition it was also considered whether the farm was rewarded in more years with higher grades. The final group referred to the features related to the production area (three macro-areas of Italy) and its certification (DOP-IGP versus non-certified olive oils).

Previous studies in the application of the hedonic price model to the olive oil market have investigated the effects of the main categories of attributes individually. Conversely, in this

study a hedonic price model was built including all the main categories of attributes, in order to have a better evaluation about their importance in the EVOO price.

Using the expert guide for three consecutive years it was also possible to investigate the behaviours of the farms and the advantage, in terms of price premium, of being rewarded for more years. To the best knowledge of the author, none of the previous studies in the application of the hedonic price models to the olive oil sector have evaluated either the role of expert judgment or being reviewed for more consecutive years. Furthermore, since in this study, data covers several consecutive years, a panel data analysis, besides the annual OLS estimations, was also conducted, in order to study the behaviour of those farms across time, using a fixed effects models and a random one. The main advantages are: i) observing a sample in a temporal dimension; ii) getting information about past attitudes of the analyzed units; iii) reducing less *collinearity* among the variables; and last but not least, iv) increasing the size of the sample, and as a consequence the obtained estimations (Gujarati D.N., 2004; Hsiao, 2007).

The analysis covers about 402 EVOO from all Italian regions. Data comes from one of the major Italian olive oil guides: FLOS OLEI for three consecutive years (Editions 2013, 2014 and 2015). Here the 2013 edition refers to the 2011/12 production year, the 2014 edition includes data about 2012/13 EVOO production, and so forth. This has been chosen since it represents the richest one in terms of observations and attributes reported and for its well established reputation. Since in this study data covers olive oils included in selected guides for three years, a panel data analysis was also conducted.

Furthermore, among the various functional forms we selected log-linear specification. The main advantages in using a logarithmic form are: i) it is possible to mitigate the effects of the outliers; ii) it allows for deriving the elasticity (Ramirez, 2010); iii) this specific functional form can give a better control of possible problems of heteroskedasticity (Schamel & Anderson, 2003); and last but not least, iv) the interpretation of regression coefficients is more immediate: the dependent variable changes by $100 \times (e^{\text{coef}} - 1)$ percent for a one-unit increase in one of the regressors, holding all other variables fixed.

1.4 Hedonic price model: empirical applications

As previously mentioned, since data covers several consecutive years, a panel data analysis, besides the annual OLS estimations for the three considered years, was also conducted. Different panel data models were estimated: pooled ordinary least squares, random and fixed effects models.

With regard to the choice of the better model for panel data analysis, different tests were employed. Firstly, the Breusch and Pagan Lagrangian multiplier test (Breusch & Pagan, 1980) was performed in order to see if the random model is adapted better than the pooled one. The result led to accepting the null hypothesis; hence in this study, the random effects model was chosen. In relation to the choice between the random and fixed effects models, the Hausman test was performed. The p-value (greater than 0.05%) brings us to accept the null hypothesis of the reliability of the random effects model.

Overall, both models were highly significant, with a p-value less than <0.01 using the standard F-statistic for the OLS and the fixed effects model. For the random effect model the Wald chi square test shows significant results. Hence, it is possible to conclude that the variables used are improving the model.

The results across the dataset show robustness and indicate the characteristics that affect the EVOO price appreciably. In fact, observing the overall fit of the model, the R^2 shows similar values (0.37 for 2013, 0.32 for 2014, 0.35 for 2015 and for the panel, 0.34 for the pooled regression and 0.33 for the random effects model). Overall, good results for these kinds of estimation are observed, in line with values obtained in the previous studies for extra-virgin olive oil (Cabrera et al., 2015; Cacchiarelli et al., 2015b).

The main findings in this study suggest that all of the three different spheres are significantly linked to the price. In more detail, results indicated that the price of the EVOOs is a reflection of the geographical origin. The EVOOs coming from the North and Central part of the country are associated with a higher price premium compared to those from the South (Cacchiarelli et al., 2015b). The results support the hypothesis of a relation between place of origin and perceived product quality (Ribeiro & Santos, 2004; Karipidis et al., 2005; Cicia et al., 2013; Cabrera et al., 2014; Carlucci et al., 2014).

No univocal indications emerge from the presence of the Geographical Indications of Origin in line with several works on olive oil for traditionally producing countries : Cabrera et al. (2015) for the Spanish market, Aprile et al. (2012), van der Lans et al. (2001), and Scarpa and Del Giudice (2004) for Italy, and Fotopoulus and Krystallis (2012) for Greece. The results indicate that the certification still plays a minor role in the olive oil market.

The organic production method is associated with a negative price premium compared to the conventional method. The results are not aligned to previous works (Cacchiarelli et al., 2015). Considering also the results coming from the GIs there still appears a lack of awareness about the different distinctive signs of quality, as several studies (Verbeke, 2005; Privitera & Platania, 2004) have found.

The study confirmed that consumers are careful not only about the features directly related to product , but also to those related to the production process. The study confirmed that consumers are careful not only about the features directly related to the product , but also to those related to the production process. The study demonstrated a preference for products coming from small farms in terms of produced quantities (Cacchiarelli et al, 2015b), vertically integrated (positive price premium coming from the cooperative), with an onsite mill and following a traditional harvesting process. The natural way of production, as underlined by Ribeiro & Santos (2004), may have a positive impact on the perceived quality of the EVOO.

The results obtained from the study of the grade given by the experts offer important insights. The consumers seem to be positively sensitive to the farm ranking given by the experts, as a signal of current and long term quality (Benfratello et al., 2009, Roma et al., 2013). The positive price premium associated to the presence in more than a year connected to a higher grade demonstrate that the role of the expert guides is becoming an important way to overpass the barriers introduced by the asymmetric environmental information.

Finally, the sensory features are also important in the definition of the final price. The intense flavour of olive oil is strongly linked to the quality of EVOO and higher price premiums are associated compared to the medium and light ones (Karipidis et al. 2005; Cicia et al., 2013) as well as the varieties used . The mono-varietal olive oil seems to be

perceived positively, as a recent trend observed in the Italian market and in line with previous works (Carlucci et al., 2014; Cacchiarelli et al., 2015b), and can be used, in a sophisticated market, as a tool of promotion of the geographical origin based on the plant varieties. On the contrary, the local varieties are perceived negatively, even if most of the mono-varietal olive oils are produced with local plant varieties. As expected, in line with previous studies, the bottle size is inversely related with the price of the olive oil.

1.5 Concluding remarks and further extensions

This work has significant implications for several stakeholders. From a theoretical point of view, it is relevant since it extends the current literature and at the same time it provides a framework to be used in future research. In fact, very few works are present in the application of the hedonic price model applied to the Italian olive oil sector, using data offered from expert guides, and to the best knowledge of the author, none of them used a panel data analysis.

An increased knowledge about the highest segment of the market opens important perspectives from a managerial point of view. The differentiation based on high quality and on the study of consumers' preferences can be seen as a tool for promoting a product that is facing a strong competition. Comprehension of which attributes are preferred by the consumers can help the farm to focus their attention on those attributes associated with a positive price premium, in terms of advertising and promotion.

The findings of this study might contribute and give useful insights of the use of the GIs system. The European certification system (PDO and PGI quality scheme) associated with non significant coefficients suggests that the geographical and varietal diversity can be promoted more by the use of the GIs system. In addition it would be appropriate to encourage the promotion and information campaigns aimed at highlighting the characteristics of each area and promote the image of the excellences of the olive oil sector-

Studying the factors that are able to influence the price of EVOO is recommended for future research. It will be interesting to include more characteristics such as the such as the production of the EVOOs in terms of bottle produced and information about the market

where the olive oils are sold (national or designated to foreign markets, the level of investments in all those activities related to the promotion and advertisement, in order to have a better and complete vision about the olive oil market.

Referring to the available database, it will be appealing to include other years in the panel data analysis, while new guides will be available in the market.

It will also be interesting to study other producer countries of olive oil in the Mediterranean basin. Ultimately, it will be useful to compare these results with others coming from different segment of the olive oil market as well as in wine to seek out the differences and similarities.

INTRODUCTION AND RESEARCH QUESTIONS

Olive oil (OO) is a pure juice obtained from of the highest quality olives and is traditionally one of the most important and peculiar elements of the Mediterranean diet. Its sensory and nutritional properties are at the base of widening consumption and increasing economic value.

For the olive oil market, qualitative aspects are emerging recently with a strong differentiation process. In the last decades the concept of quality became more sophisticated, including all those characteristics related to the health, quality, safety, hedonism and ethical aspects.

For this reason it is important to understand in terms of differentiation strategy which qualitative variables are able to affect the decision of the final consumers and consequently the value associated to each attribute. In light of the considerations, knowledge about how the qualitative cues are evaluated by the final consumers becomes more and more important in order to increase the added value of EVOO, and differentiate the product with respect to the competitors.

This study aim is to generate an awareness and insights about the role of different quality attributes in the Italian extra virgin olive oil price formation, in high market segments.

In an effort to find out the answer to this question, a hedonic price method is applied to assess the role of different qualitative clues on the price of extra virgin olive oil, through time. The quality clues refer to three different spheres: attributes directly related to the product, features related to the farm and to the production process and those related to the geographical origin.

This work has significant implications for several stakeholders. From a theoretical point of view, it is relevant since it extends the current literature and at the same time it provides a framework to be used in future research. In fact, very few works are present in the application of the hedonic price model applied to the Italian olive oil sector, using data offered from expert guides, and to the best knowledge of the author, none of them used a panel data analysis.

An increased knowledge about the highest segment of the market opens important perspectives from a managerial point of view. The differentiation based on high quality and on the study of consumers' preferences can be seen as a tool for promoting a product that is facing a strong competition. The comprehension on which attributes are preferred by the consumers can help the farm to focus their attention on those attributes associated with a positive price premium, in terms of advertisement and promotion.

The first chapter will firstly give an overview about the world olive oil sector, focusing on the Italian olive oil market. In the second chapter, the theoretical significance of the study is provided, looking at the role of the quality for the olive oil market, and to the theoretical background of the hedonic price modeling. Subsequently, a brief description of the functional forms used so far for the estimation of the hedonic price model and an overview about panel data analysis will be addressed. Then, a description of the data which has been used in our work will be offered. Finally the estimated results will be shown and lastly the managerial implications and conclusions will be discussed.

CHAPTER 1:

Contextual setting

1.1 The world olive oil market

The production of olive oil is one of the oldest traditional agricultural productions in the Mediterranean basin. Known since ancient times, olive oil has been part of the daily diet and it was attributed sacred meanings and uses in ancient rituals.

In the Mediterranean countries, the olive oil sector, in terms of production⁴, consumption and trade, has a strategic role (Bernini Carri & Sassi, 2007).

In terms of volumes, Europe produces on average 70%⁵ of the world production: Spain, Italy and Greece represent the major producers. With an annual mean consumption of about 1323 millions of tonnes in the 2009 – 2014 period (IOOC,2016), they are also the main consumers of olive oil.

The free market orientation and the extension of the production boundaries, not only related to the Mediterranean basin, cause a stronger competition. Outside the European borders, olive oil is produced in other Mediterranean countries, namely Tunisia (6% of the world production), Turkey (5.7%), Syria (5.6%) and Morocco (4.2%), as well as in relatively minor quantities in the American continent (0.2% in the last five years) and Australia (with a share of 0.5%).

In the last decade, based on the data provided by the IOOC, the world olive production has recorded a stable positive trend, despite a collapse in the registered olive production in 2014/15 in Europe, due to a discouraging season in Spain that lost 53% in percentage terms with respect to the previous year, followed by Italy by about 34% (IOOC, 2016). The provisional data for the 2014/15 season of the shares of the worldwide production are as follows: Europe 69%, North Africa 8.8%, Turkey 4.8%, and Syria 4.2%, with the others producer countries at 9.6%. Looking at data for the production of olive oil, the trend of the production of olive oil that follows the biological cycle of the olive tree has to be

⁴ The non-Mediterranean countries count for less than 2.5 % of the world production (Anania&PupoD'Andrea, 2008).

⁵ Average annual production in the period 2009/10 - 2014/15 of about 2.034 millions of tones (IOOC, 2016).

considered, which is estimated to about two years (Sabbatini, 2014), together with the volatility related to the weather conditions.

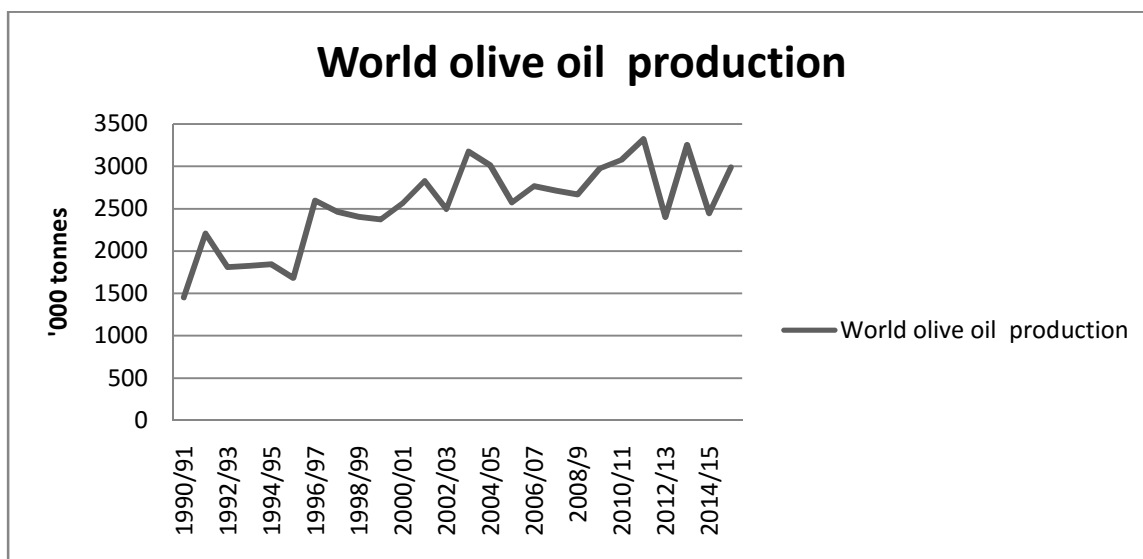


Figure 1 World production of olive oil. Author's elaboration. Source: IOOC, accessed February 2016

The world production of extra-virgin olive oil, as is possible to observe in Fig. 2, from data offered by FAO (2015), increased over the years, in order to meet the increasing international demand. The world production of extra-virgin olive oil passed from 0.14 million tonnes in 1961 to 3.5million of tonnes in 2012.

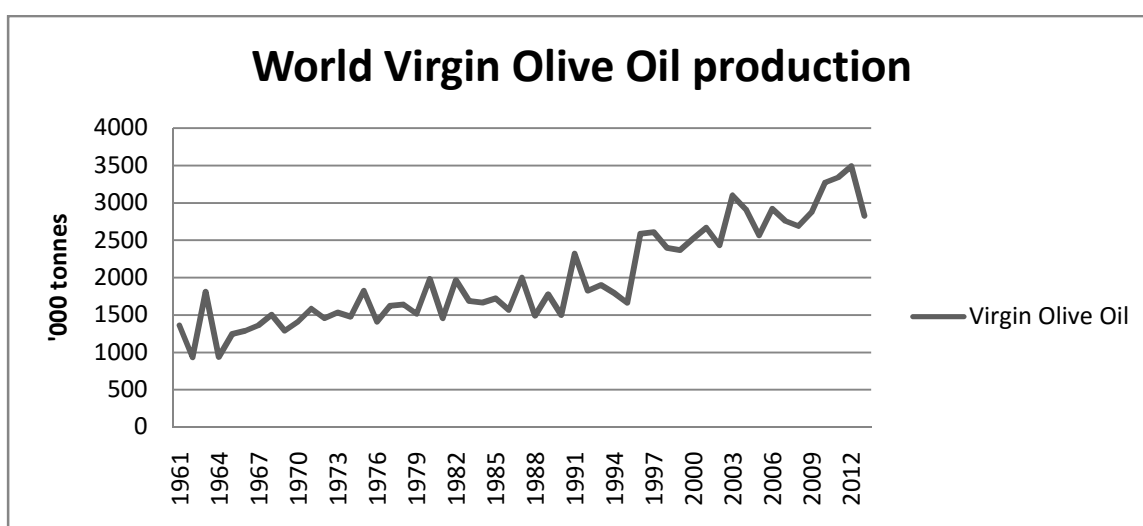


Figure 2World production of virgin olive oil. Author's elaboration. Source FAOSTAT, accessed 02 September 2015

Olive oil production for the Mediterranean countries has important social impacts not only by being a source of income for the rural economy, but also by maintaining the cultural and environmental heritage (Areal & Riesgo, 2012). In some European regions, olive oil is the most important agricultural activity, in terms of employment and percentage of cultivated area.

Spain is the main olive oil and olive producers (1.8 million tonnes in the production season 2013/14). Italy is the second European producer of olive oil with a share on the total European production of about 19%⁶. Greece is the third producer (on average 350 thousand tonnes for the past five years, of which 82% is extra virgin). In terms of land, Greece is the first country for olive growing with a share of 14% of the total land dedicated to growing the crop, followed by Cyprus (10%), Italy and Spain (both with a share of 9%) (Mylonas, 2015), and it is the first world's main producer of black olives.

The total olive oil geographical indication (GI) recognitions among all Europe are 116. Of these, 40% are Italian, with 42 Protected Designation of Origin (PDO) and 1 Protected Geographical Indication (PGI), widespread over the whole national territory. Greece and Spain follow at a distance, with a number of EU recognitions respectively equal to 27 and 18.

The main producer countries of the Mediterranean basin represent the traditional consumers of olive oil. The three main European olive oil producers are, at the same time, the major consumers absorbing almost half of the total world consumption: Italy has a share of 22%⁷ of the total world olive oil consumption, followed by Spain 19% and Greece 7%.

However, the consumption of olive oil is spreading to non-traditional areas of the world, through factors such as nutritional features, health claims, promotional campaigns and migration from European countries. The main consumer outside Europe is the US (10% of the world consumption, with an average annual consumption per capita of 1kg⁸) (Mylonas, 2015) with an increasing demand. In ten years (2000 to 2010), its consumption has increased from 170 to 277 thousand tonnes (IOOC, 2016), remaining the largest market

⁶468 thousand tonnes in the 2013/14 production season.

⁷Italy represents the first European consumer of olive oil, with a percentage consumption in the last five years of about 35% (609 thousand of tonnes).

⁸ Spain, Italy and Greece have an annual average consumption per capita of about 10-12 Kilograms).

among non-traditional consumers. There are, in fact, countries that over time saw coming within their borders, conspicuous colonies of emigrants from olive oil producing countries⁹. The American consumers are those that only recently have moved closer to the Mediterranean diet due to an increasing knowledge about the health qualities of the olive oil. Benefitting from the increased US demand in 2011, Spain remains in the first place as supplier, before Italy and Greece. A market with a high potential for EU olive oil production is China where olive oil could represent in the next years a luxury good for the Chinese consumers who have increased their consumption of olive oil by 69%, since 2008. In the last five years, China represented 2% of the world consumption.

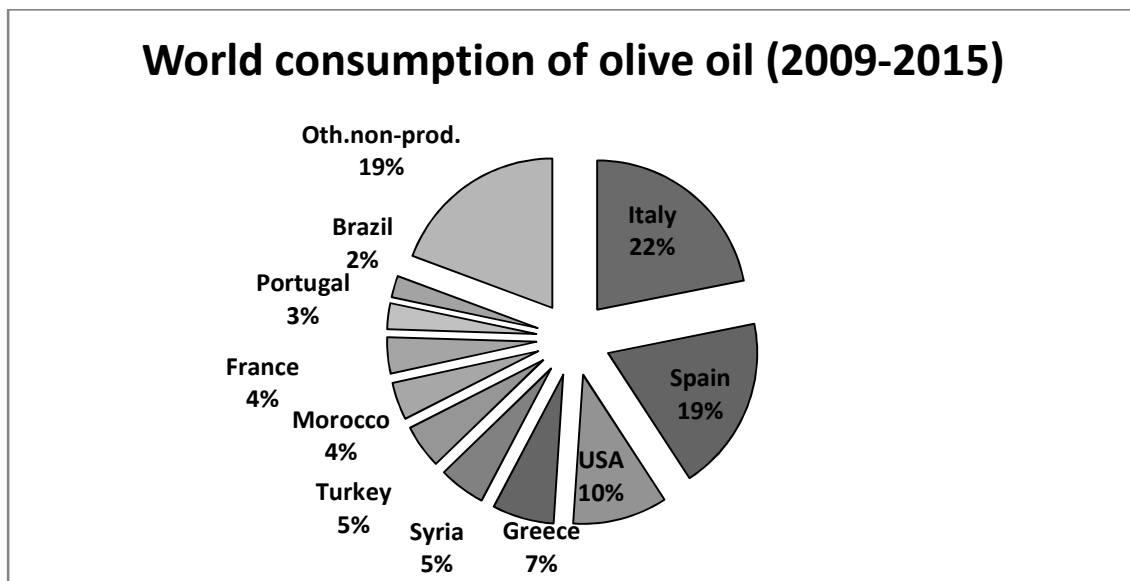


Figure 3 World olive oil consumption 2009-2015 . Author's elaboration. Source: IOOC, accessed February 2016

Despite the global economic crisis, the international trade of olive oil remains strong. The world olive oil exports of olive oil (without the intra-community trade) have doubled, passing from 337 thousand tonnes, registered in the production 1990/91season, to 785 thousand tonnes in 2013/14 (IOOC, 2016). The same positive trend was observed for the exports of virgin olive oil. According to data retrieved from FAOSTAT, the exports have increased sensibly during the 1961-2012period, passing from 0.20 millions tonnes in 1961 to 1.7 million tonnes in 2012.

⁹In the past many immigrants from Italy and Greece came to the American continent, bringing with them culinary traditions and importing products from their countries of origin.

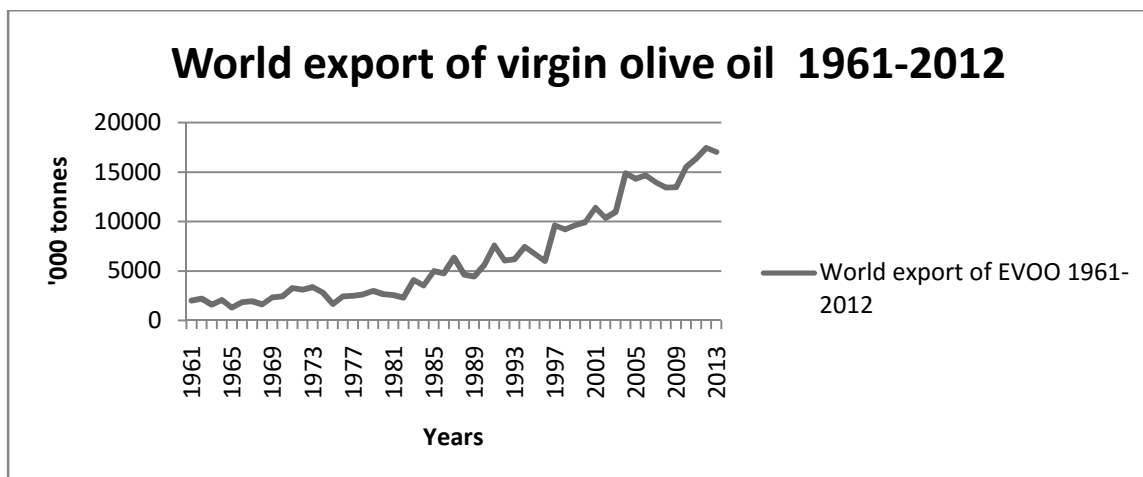


Figure 4 World exports of virgin olive oil. Author's elaboration. Source: FAOSTAT, accessed December 2015.

Europe is the main world exporter in the world accounting for 621,000 thousands of tonnes of olive oil(79%). Spain hold the position of exporter of olive oil within Europe. During the season 2013/14, Spain's average share of world exports was 50%, followed by Italy with 40%, Portugal (9%), Tunisia (8%), Turkey (4%)and Greece (1%).

In particular, USA is the country with the highest average share on imports for virgin olive oil (share of 39% for the last 51 years) followed by Brazil and Italy (9% each one).

1.2 The Italian oil sector

In Italy, olive oil production represents one of the major activities in the agricultural sectors, both in terms of income generated and employment as well as in terms of image and reputation. In order to underline the importance of the production of olive oil in the country, it is worth noting that Italy has the highest number of olive varieties (more than 500 are counted).The production of oil and olives is present throughout the Italian territory, including the islands.

As it is possible to observe in Fig. 5, the production of olive oil passed from 163.000 tonnes in 1991 to 540 thousand tonnes in the 2008/09production season. The Italian production of olive oil, according to data retrieved from IOOC (2016), has dropped sharply during the period from 2009/10 to 2015/16 (provisional data) by 18.6%, with the most

significant decreased observed during the 2014/2015 production year.

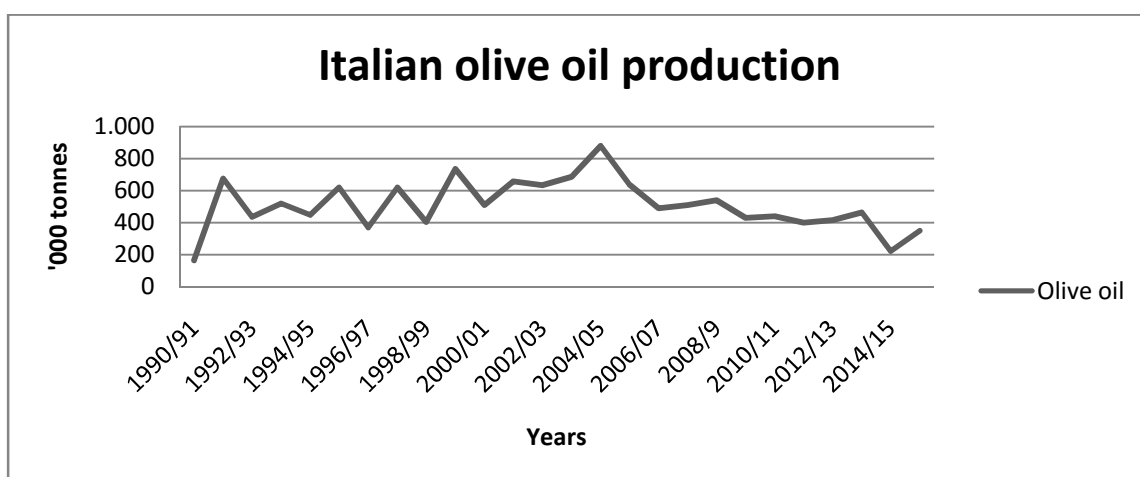


Figure 5 Italian production of olive oil. Author's elaboration. Source: IOOC, accessed February 2016

In the last decade a turn to a more qualitative production has been promoted for the Italian olive oil sector. About two-thirds of Italian olive production is represented by extra virgin olive oil.

The production of virgin olive oil for Italy, as shown in Fig. 6, remained stable during the 1992 - 2013 production years. The mean production of virgin olive oil during this period is 565.000 tonnes. The 2014/15 production season was the year of the collapse of the Italian olive production; according to provisional data, a reduction of approximately 35% was calculated on a national scale (IOOC, 2016) with peaks of 80% in the qualitatively most important regions such as Tuscany and Umbria. In addition to the adverse weather conditions, the attack of a parasite called "*Mosca*" in several Italian regions resulted in a reduction of the Italian production both in terms of quantity and quality (Ismea -Qualivita, 2014).

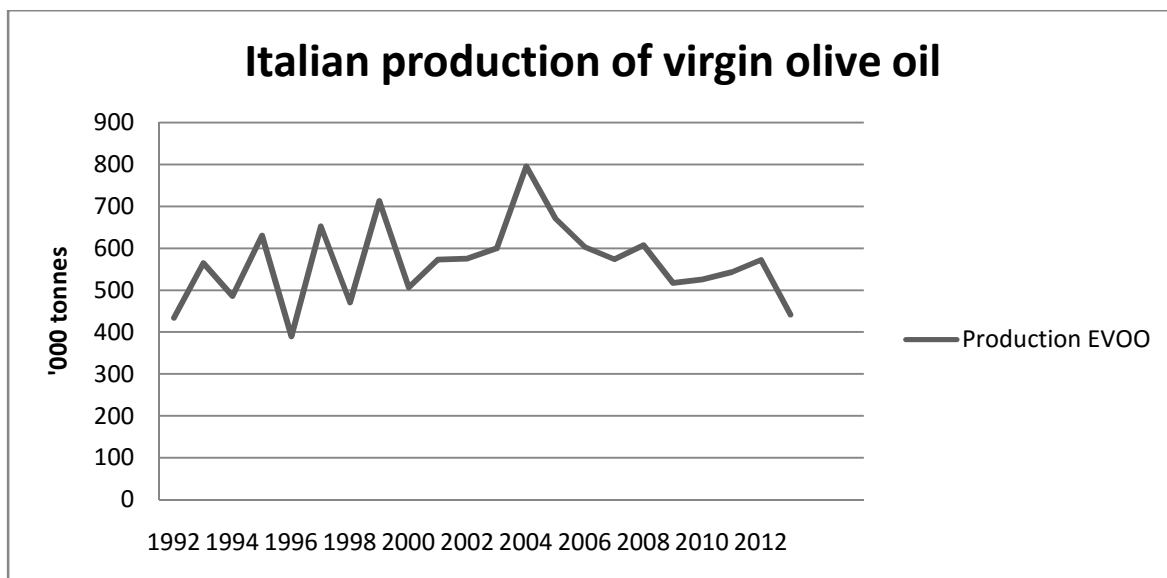


Figure 6 Italian production of virgin olive oil. Source: FAOSTAT, accessed February 2016

At the European level, Italy is the first importer (share of 78% of the total European imports). Italy buys from North Africa (Morocco and Tunisia), but also from other European countries (Spain¹⁰ and Greece). The big manufacturing companies in Italy buy bulk olive oil in order to blend them for branded product processing for the industrial and for the final market, both domestic and international. According to Mylonas (2015), these companies are able to dominate the market due to the combination of different strategies strongly associated with the country's reputation, brand name, and at the same time, large quantities.

Regarding the Italian olive oil trade, in terms of imports (excluding the intra-Community trade), the average production was 92 million tonnes during the 1990 -2013 period, while for the same period the average level of exports from non-EU countries was 164 million tonnes, with an increase in the last decade of 15%.

¹⁰Spain is the first supplier with a share of the total annual Italian imports of EVOO of about 65%.

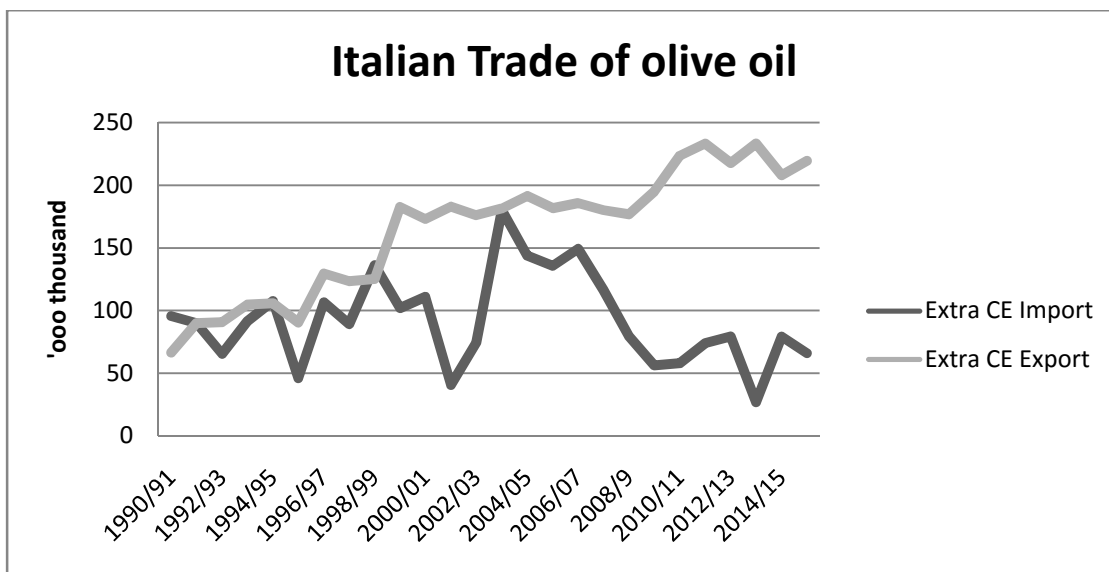


Figure 7. Italian imports and exports of olive oil. Source: IOOC, accessed February 2016

Italy is a significant net importer of virgin olive oil. The level of imports has shown high variability during the last decade but the trend is positive. In relation to exports of virgin olive oil, a positive trend can be observed, with a constant increase in the Italian virgin olive oil exports during the last decade, as can be observed in Fig 8.

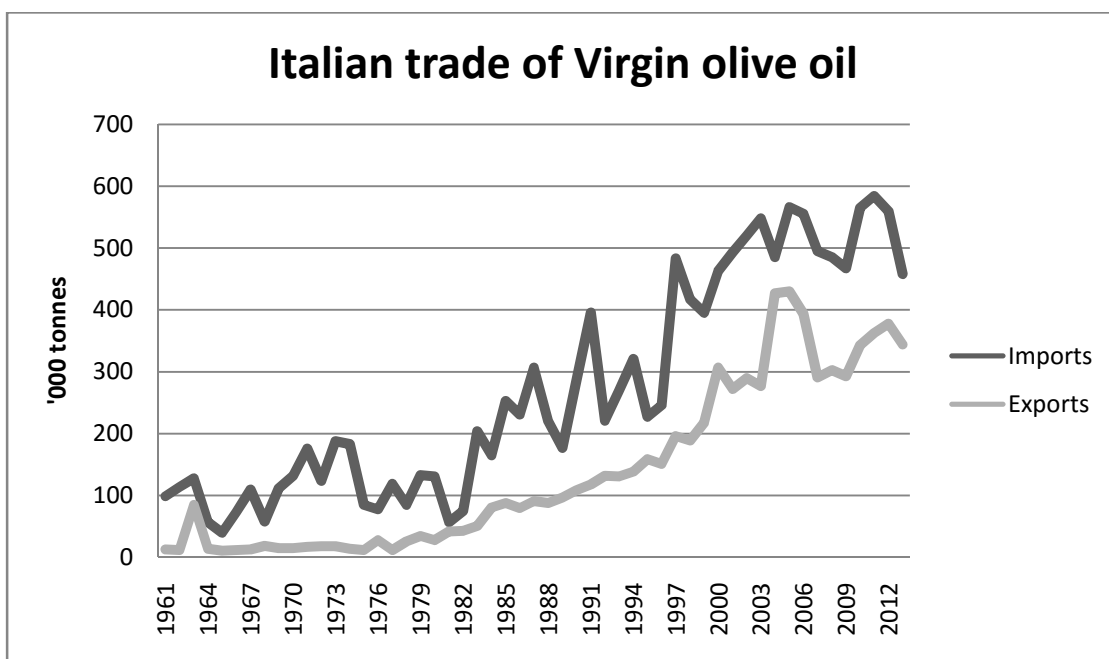


Figure 8. Italian imports and exports of virgin olive oil Source FAOSTAT, accessed February 2016

The major importers of Italian virgin and extra-virgin olive oil are the US with a share on the total annual Italian exports of about 31%, followed by European countries, namely Germany (15.6%) and France (9.1%) (INEA, 2013).

In terms of land productivity, among the European countries, Italy, and Greece have the highest productivity with an average of 3 tonnes of olives per hectare of the olive growing area. However, according to the Farm Accountancy Data Network (FADN) database (European Commission, 2012), the highest labour productivity of olive farms is attributed to Spain, with an average of 45 tons of olives per employee¹¹, while Italy and Greece have a lower level (26 and 19 tons respectively).

The Italian olive oil farms are small (about 3 ha) (ISTAT: 2016) and most of them are family-run. The olive area in Italy is fragmented and anchored to the tradition, especially in Southern Italy. This results in high production costs that are higher in Italy when compared to other European olive oil producing countries like Spain, which has large production plants and a highly mechanized production system. Olive oil farms are on average bigger in Spain (12 ha of olive groves) when compared to Greece and Italy (both 3 Ha). A common theme for both Italy and Greece is that the sector is dominated by relatively small farms with a low degree of commercial and professional training.

The Italian olive oil heritage is estimated at 150 million olive trees for a total area of 1,165,458 hectares (ISTAT, 2016). Olive cultivation is present in eighteen regions out of twenty (excluding Valle d'Aosta and Piedmont). In the last decade a turn to a more qualitative production has been promoted for the Italian olive oil sector. In fact, two thirds of the Italian olive oil production is extra-virgin olive oil.

The production of olive oil is a priority of Southern Italy. In terms of quantities produced (INEA: 2015), considering the last decade (from 2000 to 2013), the main producers of olive oil are represented by Calabria, Puglia, Sicilia and Campania with a share of 35%, 32% , 9% and 7% respectively, equal to an average of 453.000 tonnes. Regions such as Abruzzi, Lazio, Tuscany, and Umbria from the Central part of the country have a share on the total production of about 12%, and other regions from the Northern part have a share of

¹¹This is mainly related to the Spanish high level of mechanisation and the relatively big areas devoted to olive growing (Sabbatini et al, 2015).

less than 1%, while a residual portion is associated to other regions from the Central and Southern part of the country.

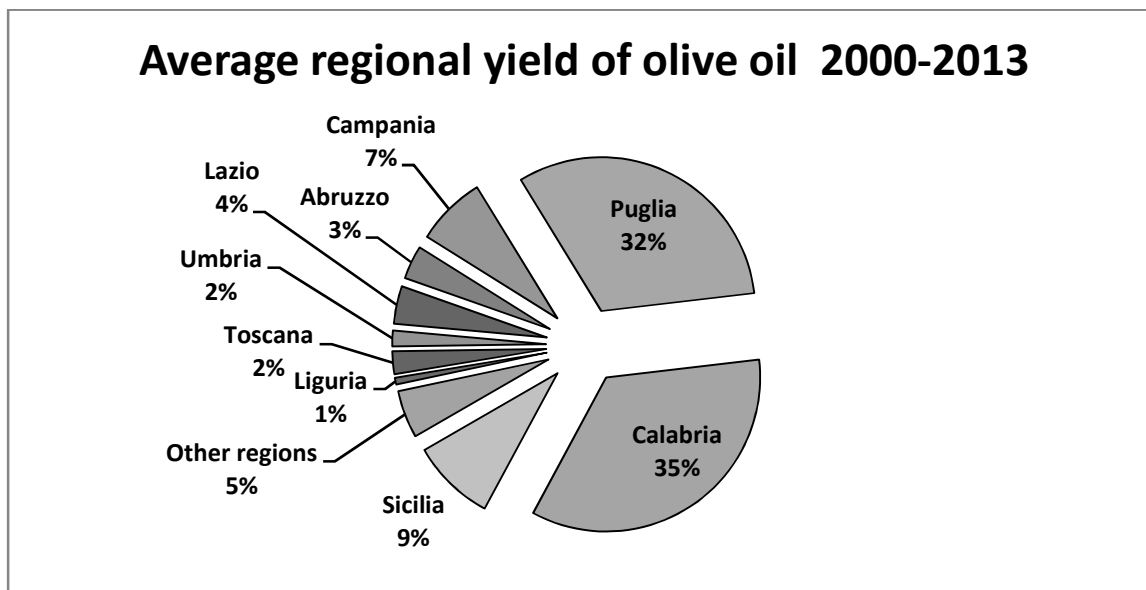


Figure 9. Average regional yield of olive oil Author's elaboration. Source: INEA, accessed October 2015.

Overall, observing the data retrieved from ISTAT (2016), the olive oil farms that produced olives for olive oil have increased from 2003 to 2010 by about 2%. About 70% of the farms that are dedicated to the production of oil are under 2 hectares.

Puglia has the highest number of olive farms (226229) with a share on total Italian olive oil farms equal to 25%, followed by Sicily (15%), Calabria (13%) and Campania (10%). Other regions of the South, Basilicata and Sardinia, have a considerably lower number of farms dedicated to olive growing with an overall share of 7%. In the Central part of the Italian territory, Lazio has the highest percentage of farms (8%), followed by Toscana and Abruzzi (respectively with 6%).

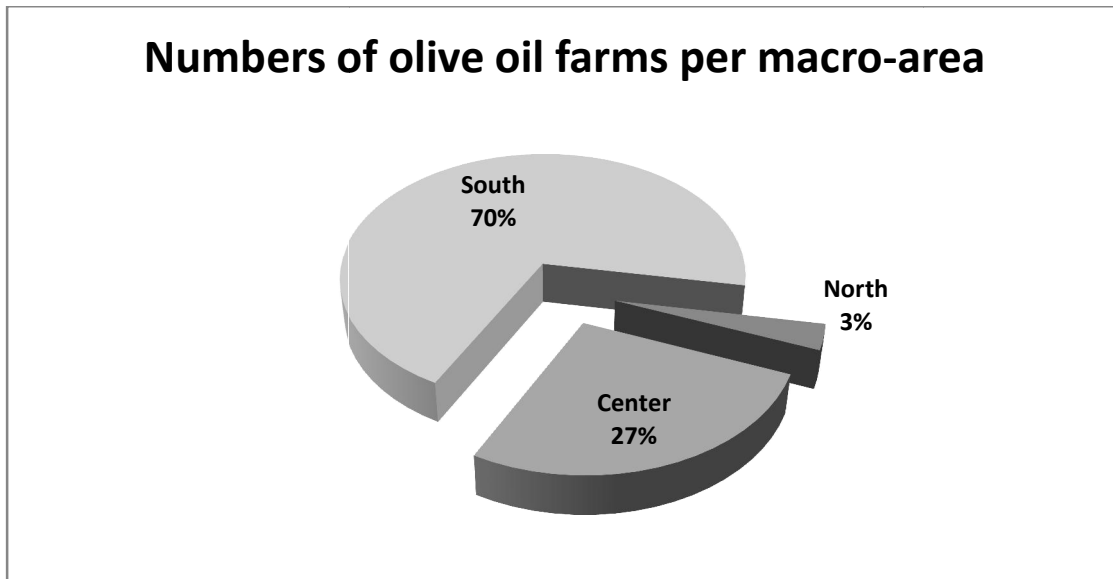


Figure 10. Numbers of olive oil farms per macro area. Author's elaboration. Source ISTAT , accessed January 2016

1.2.1 The Italian GI extra-Virgin olive oil sector

Recently there has been a great interest to retrain the Italian olive oil sector promoting the history and the traditions of the local contexts from which they are derived.

Italy has the most Protected Denominations of Origin (PDO) and Protected Geographic Indications (PGI) than any other EU olive oil producing countries (Sabbatini et al, 2016b). In particular, 42 PDO and 1PGI (Toscana) are counted, and represent about 40% of protected European olive oil.

In terms of PDOs, the national record is held by Sicily with six PDOs, followed by Puglia and Campania (both with five), from Tuscany and Lazio (both with four) and Calabria and Abruzzi (both with three).

The sector of extra virgin olive oils is in fifth place in the ranking of the turnover calculated at the origin, on the overall GI Italian sector, with a production value of around €80 million (Ismea- Qualivita, 2013). Despite this, it has a very low incidence of the overall value of the Italian certified sector, equal to about 1% for both production and consumption.

Even if Italy has the highest numbers of EVOO GI recognitions, the whole certified production counts only for 10,919 tons (Ismea-Qualivita, 2013), counting for less than 2% of the total Italian olive oil production. Of these, an impressive 34% comes from the Terra di Bari PDO, and 27% from Tuscany (*Olio Toscano PGI*), followed at a distance from Val di Mazara PDO with 6% and Umbria PDO with 5%. The remaining 28% is shared between the other 36 Italian PDOs.

Geographical Indication	Region	AVG 2010-2013	Share
Terra di Bari DOP	Puglia	3173	29%
Toscana IGP	Toscana	3521	32%
Val di Mazara DOP	Sicilia	727	7%
Umbria DOP	Umbria	626	6%
Riviera Ligure DOP	Liguria	472	4%
Monti Iblei DOP	Sicilia	251	2%
Garda DOP	Veneto- Lombardia	291	3%
Sardegna DOP	Sardegna	157	1%
Dauno DOP	Puglia	189	2%
Bruzio DOP	Calabria	205	2%
Valli Trapanesi DOP	Sicilia	263	2%
Sabina DOP	Lazio	179	2%
Others		1345	12%
Tot GIs EVOOs		10969	100%

Figure 11. Certified production Certified EVOO. Author's elaboration. Source: Ismea -Qualivita (2012-2013-2014-2015)

Of the approximately €80 million produced, 64% comes from the foreign markets, while the sales for consumption on the domestic market amounted to just over €26 million.

In terms of turnover at the production, the share of the total olive oil production accounts for 6%. The first two Italian GIs, Toscano PGI and Terra di Bari PDO, together cover 2/3 of total certified production. The top five GIs account for 80% of the total certified olive oil production, with the top ten at about 91%. This can be attributed to the fact that the major national packaging industries are adjacent to places of production of these Certified products (Alfei et al., 2013).

As reported by Qualivita- Ismea (2012), in 2011 the sales production of DOP and IGP oils increased by more than 18% following an increase in average prices at the origin, while the consumption on the domestic market grew by 6.6% due to a decline in the retail price. In 2012 the sales production of DOP and IGP oils decreased by almost 4% as a result also of a decrease in average prices at the origin, while the consumption in the domestic market

was down by 9.4%, partly because of a drop in the quantities for the domestic market in favor of much more profitable foreign markets, a phenomenon that was occurring for a three-year period. In 2013, the turnover in the upstream phase of the supply chain of the DOP and IGP oils increased by almost 4% later also to a rise in prices, while consumption in the domestic market grew by 5.1%, partly due in this case to an increase in the average retail price lists.

The PDO and PGI EVOOs represent the highest level of quality, and although they still express a limited percentage of the average consumption, they manage to obtain recognition of price premium compared to the common extra-virgin olive oil at about 54% (Ismea, 2016).

The PDO labeling has a very different economic relevance in the different areas of Italy (for example North versus South). The average price for certified extra virgin olive oil stood at an average value of €6.96 / kg (2011-2014). However, prices widely vary depending on the analyzed EVOOs. On average the highest value observed for the PDO Brisighella (Emilia Romagna) with an average price rise amounted to €18.50 / kg, while the lower one is for the Terre di Bari PDO (€3.21 / Kg), which is also the bigger producer in terms of quantities.

Data on sales prices for the large retail chains, observed by Unaprol (2012), based on the IRI-Infoscan dataset, confirm that the certified olive oil is the one that manages to get higher quotations with respects to olive oil, especially in the North, while in the South the difference is less. For example, in 2012 in Trentino the average recorded price was €12.37 /Lt, followed by Lombardi (€10.88/Lt) and Veneto (€10.85 /Lt). For the Center, the highest prices were registered in Toscana (€10.51/Lt) and Lazio (€10.40/Lt). In the Southern part the prices were lower especially in Puglia (€5.04/Lt).

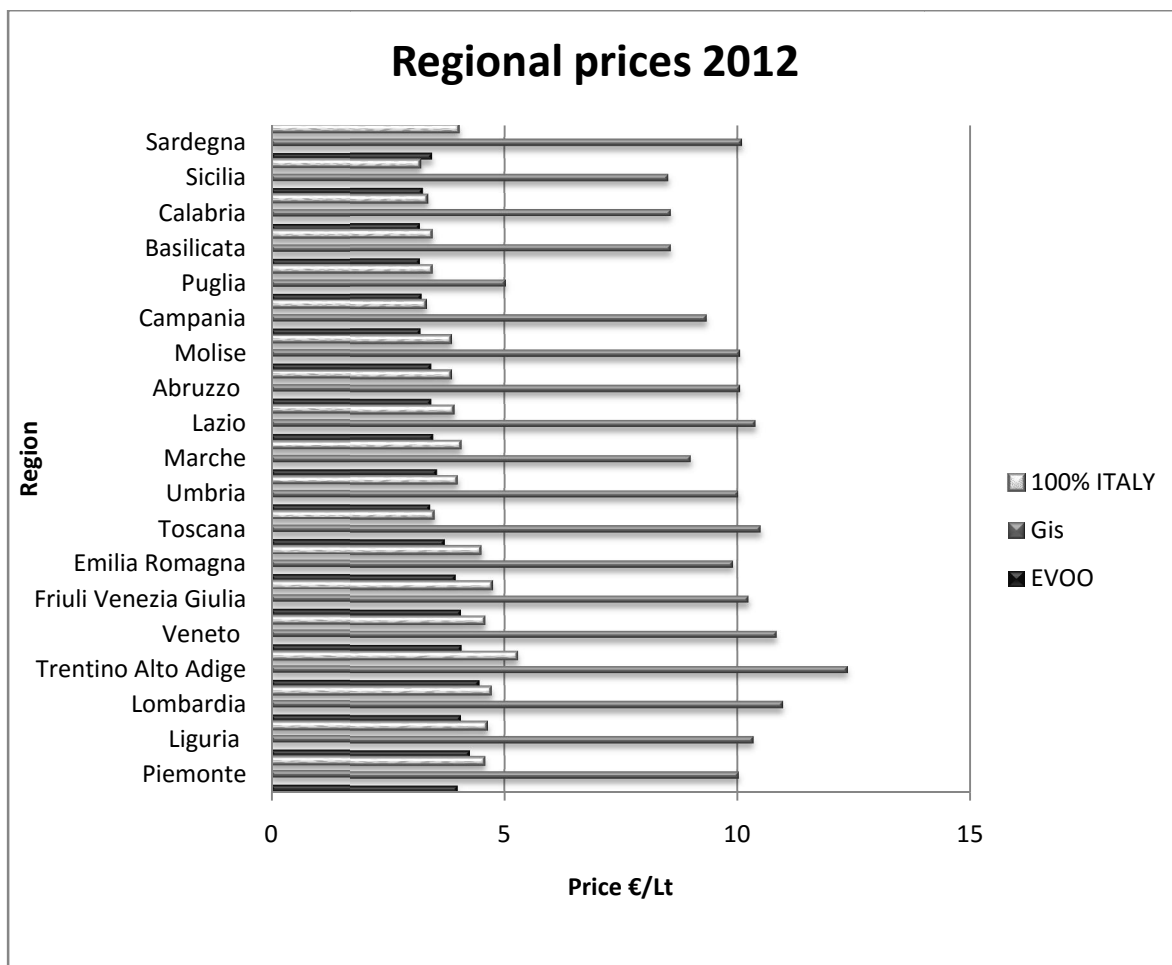


Figure 12. Regional prices 2012. Author's elaboration. Source: Unaprol (2012)

1.2.2 The Italian olive oil organic farming

Recently, the Italian organic olive oil sector has seen an increase in terms of farms and cultivated areas. Due to its biological characteristics the olive crop is relatively easy to convert to organic farming as it does not require specific additional investments or other inputs.

Based on recent data offered by SINAB (2016) , 13% of the organic crop areas are dedicated to olive growing. The area dedicated to organic olive growing has increased since 2009 by about 21%, passing from 137 863 hectares in 2009 to 174 560 hectares in 2013.

The organic olive oil production is concentrated at 77% in the Southern areas, in particular Calabria (31%), Puglia (22%) and among the islands, Sicily (10%) stands out in importance. For the other macro-areas Toscana has a percentage equal to 8% and Lazio (5%), while in the Northern area residual percentages are counted. In terms of proportion of area devoted to organic farming, the leader here is Friuli-Venezia Giulia (48%), because the colder weather greatly reduces parasitic infestations. In fact, organic farming follows the dictates of the EU Reg. 834/07 (implemented by the following EU Reg. n. 889/08), establishing the list of natural substances allowed in organic farming for fertilization and crop protection. That regulation provides for the prohibition of the use of GMOs and from July 2010 the use of the EU logo is mandatory on the label for products of community origin that contain at least 95% organic ingredients.

From the little available information from the commercial front, the organic olive oil market looks very promising in terms of production and prices. Just consider that the prices of the organic EVOO production, according to ISMEA (2016), exceed by more than 25% the price of conventional extra virgin olive oil, even if from 2011, this percentage has decreased from 26 to 19%, due to the increasing prices of the conventional production registered in the last available year (2014). In detail, observing the average prices of the Italian organic olive oil, offered by Ismea (2016), a stable trend in the medium term is noticed, which nevertheless manifests very large annual fluctuations. From 2011 to 2012 the average prices provided by ISMEA (2016) dropped by about 12%, passing from 4.28 €/Kg to 3.76 €/Kg, then returning to previous levels in 2013 of 4.31 €/Kg and further increasing slightly in 2014 with a mean price of about 4.79€/Kg. In the last year considered, an almost stationary trend is reported until September which then undergoes a rapid increase in recent months coming up to a price recorded in December 2014 of 6.41 €/Kg.

CHAPTER 2:

LITERATURE REVIEW

2.1 The role of quality in the agricultural sector

In recent years the role of agriculture has changed considerably. The loss of centrality of the sector, due to a strong process of industrialization, coupled with the rigidity of demand for agro-food products (Sodano et al., 2010) has meant that agriculture has lost its role as a social stabilizer and major employment sector. In the post-industrialized economies, the role of agriculture has undergone a process of change. The shredding of the social fabric together with a proliferation of lifestyles have helped to enrich and make more complex the contribution of agriculture. The major interchange with professional figures, combined with ease of access to the countryside and a new interest by the young in rediscovering the agricultural heritage has changed the vision of the agricultural world. Agriculture prompted the task of preserving the ecosystem and all those traditions linked to the territory.

The demand for food products also grows with new needs expressed by consumers (Fotopoulos et al., 2009). Alongside all those attributes that only relate to the product, attention is also paid to all aspects related to the production process (such as environmental protection, lack of sophistication, organic farming). In this regard the concept of quality includes different meanings. Quality binds more and more to the ability of a product to meet the complex needs of each consumer, ensuring the capture and maintaining a market segment, combined with a growing interest in well-being aspects, which has contributed to increasing the interest in high-quality products.

There is a decrease in the share of income of consumers dedicated to food consumption (in developed countries the average percentage of income destined for food consumption is less than 25-20%, while in developing countries it may also be well above 40-50%) (Pilati, 2004).

The evolution of the demand for agricultural products offers many opportunities to the Italian agro-food system. Italian traditions are renowned and appreciated even outside the national borders. The richness and variety of the heritage linked to food, however, is not

fully exploited. The increasing attention to those aspects related to food safety issues has brought a better organization of production chains to ensure product traceability. This represents a strong incentive for producers, especially the small ones that characterized the Italian food sector, to organize themselves in order to sell their product.

In the following paragraphs the role of quality in the food market will be analyzed in detail, starting from the definition of attributes related to olive oil and the review contributions from the literature. Later, the focus will be on the functioning of the markets when quality is relevant and the presence of asymmetric information. Finally, the demand side will be presented and the hedonic pricing model proposed by Rosen (1974) will be introduced.

2.2 Role of quality and information in a differentiated market

Nowadays markets are characterized by the presence of non-homogeneous products, from a qualitative point of view. The theoretical models in the case of differentiated product are referred to those market characterized by imperfect competition oligopoly and monopoly; all market forms where, differently than perfect competition¹², the firms are able to influence the price in the market.

Companies relying on markets with differentiated goods sell products that can be replaced with others, but to a limited extent, and so do not passively suffer the price imposed by the market. In these "imperfect" markets, profits and market share can be safeguarded with strategies of differentiation. Differentiation can be distinguished vertically or horizontally. The first form of differentiation concerns goods that can be objectively ordered from best to worst, on a scale which is the same for all consumers. It is called horizontal differentiation, the differentiation based on the consumer preferences. In other words,

¹²In a perfect competitive market is present only one good, that is homogeneous, and the firms are price taker, that means they do not have any market power and so, their decisions do not affect the final price. The considered firms are in large number and small in relation to the market demand. In this market among all the stakeholders there is perfect information, in which all the firms know all the prices of all the firms, and the same happens for the consumers. Then, there is symmetric technology, that means that all the firms have access to the same technology available. Lastly, there are no entry/exit barriers.

leaving the same price, if every consumer prefers one over other products and it establishes a ranking (quality) to the consumer's eyes, it faces a vertical differentiation. Otherwise, if a good differs from another by one or more characteristics, but is not possible to establish a ranking (quality) that is the same for all the consumers, the products are horizontally differentiated.

The uncertainty derived by the quality of the product has been analyzed in terms of asymmetric information. If the consumers cannot observe product quality or other features, while firms do, the market is facing a problem of asymmetric information. Akerlof (1970) was the first economist that understood the failure of the market caused by asymmetric information¹³. The well-known contributions of Akerlof about those markets were dominated by information asymmetry: if the characteristics of the product are not sufficiently known to the consumers, it creates an incentive to moral hazard behavior by the firms, that leads to low quality products in the market.

The main problem regarding asymmetric information is represented by the adverse selection, that leads to reduced quality in the market and leads only goods of poor quality in the market (the so-called 'lemons'). Only if the seller can prove with certainty the characteristics of the product sold is the asymmetric information problem solved. The producer may decide arbitrarily to hide some information about the quality of the product, that leads to a hidden action problem; if some features are not directly controlled it faces a problem of hidden information. On the contrary, a firm can decide to reveal to the market all the information about the product, anticipating the competitors, and perceive as low-quality producers those who hide information. When the company instead decides arbitrarily to hide the quality of the product, making a *hidden action*, the company does not need to convince the consumers about the quality of the good, but it can mimic the behavior of giving a high quality product, falling short by little from the observed market price for these products. In this case the so-called moral hazard problem is observed, leading the consumer to believe that it is a high quality product, and hence a market failure.

According to Nelson (1970), two kinds of goods are distinguished based on the information available in the market: *search* and *experience goods*. The economic theory

¹³The most used example for explaining the problem of asymmetric information is the market for used cars. In a particular case, the firm, (in this case the owner of the car) knows the real state of the good, while the consumer cannot ascertain the real features of that good.

deals in most of the cases with *search goods*. The consumers are aware of the characteristics of these products or services and they can evaluate them before the purchase. On the contrary, in the case of *experience goods*, the features can be ascertained only after the purchase, since they are harder to be recognized by the consumers.

A later contribution of Darby & Karni (1973) introduced a new category of good: the *credence* one. For the consumer it is not possible to know the quality, even in its normal use, so public intervention is needed (for example in the field of the GMO agricultural product).

Most products cannot be included in a specific category, but their attributes can.

From the distinction between *search* and *experience* goods the kind of advertising can be inferred. In fact, while for *search* goods a firm needs to give information about the characteristics of the product, for *experience* goods it needs to persuade consumers to buy that product. As quantified by Nelson (1974), the advertising costs are two thirds higher for experience goods than search goods, since there is the need to persuade consumers to buy that product, without being aware of the features.

Daily firms are selling *experience goods*, introducing new branded products, with the need to meet the needs of the final consumers and make them conscious about the new product. The main challenge, that is typical for *experience goods*, is that consumers are not aware of quality before the purchase (Belleflamme & Peitz, 2011).

Regarding *search goods*, since the consumers know the quality before the purchase, no specific advertising signals are needed. On the contrary, for *experience* and *credence* products, if the producers cannot demonstrate to the final consumers the quality of the product they need to convince them by building different tools for marketing, such as price and other *advertising signals of quality*. In fact a way to signal the quality of the product is to invest in advertising (Nelson, 1974) or distorted prices. In the case of repeated purchased goods, for a high quality firm it is suggested to invest in advertising to send a message in the market about the level of the product sold and discourage all the practices of mimetic behaviors made by the low quality firms. In fact, as underlined by Milgrom & Robert (1982), a strong investment in advertising is the correct choice for the firms that sell high quality products since they have more advantages to persuade the consumers about

the real quality level compared to those that are producing at a lower level. On the contrary, the main risk is that the consumers will be not able to distinguish between high and low quality, before the purchase.

Another practice, for the *experience* goods case, is to fix the price below the marginal cost in order to attract the consumers that try the good for the first time and invite them to buy the product for a second time. However, if the consumer is already aware about the quality of the product the firm can sell at a higher price compared to the competitors that set lower prices (and provide lower quality goods), and use the higher price to attract the new consumers.

Additional strategies to be followed in an asymmetric market are represented by warranties (Spence, 1977) and branding (Cabral, 2000). A firm can decide to give back the money to the consumers in the case of no full satisfaction. Firstly, the warranty is a tool used frequently for experience goods. The warranty is a way for establishing a sort of trust and liability between the sellers and the buyers, for giving information on the market about the firm. In fact as evidenced by Belleflamme & Peitz(2011), warranties that last for more years are preferred by firms, since it is less expensive than producing higher quality products. However it can represent a strong signal of quality in order to increase the quality perception, especially when in the case of moral hazard from the firm's side.

Branding is a driver element to differentiate a product from others. The use of a brand may reduce the confusion with competing products and enhance the reputation of high-quality firms. In order to establish a reputation in the market, a firm needs to place on the market a quantity of product such as to make it visible. To do this a high amount of investment in advertising and promotion is needed, such that often only large companies can support these costs. A firm may rely on its brand and guarantee a product over time as a way to maintain the quality of the product. In support of this, if consumers rely on the past behavior of the firms, they will be led to believe that the firms will continue to provide the same high quality level, in order not to destroy the past reputation .

A firm can decide to produce more products under the same brand. This is called an *umbrella brand*, where the products sold under the same name have some kind of relation. In the case of experience goods, a consumer may rely on a firm and make inferences between the good sold under the same brand. In this way the firms are led to respect the

quality and invest in quality provision. If a consumer appreciates a product, s/he will be inclined to buy a new one that has the same name due to the positive expectation quality. In this optic the umbrella branding strategy may mitigate the problem of the moral hazard.

The agricultural market is characterized mostly by small farms. Especially in this sector, a way to overpass the asymmetric information problem is represented by the direct knowledge of the producers. In this way it is possible to create a trust relationship between the firm and the consumers. Another strategy is represented by the collective brand. This strategy allows the farms to overpass the problem of the large amount of investments needed for gaining visibility in the market, and to put in the market a sufficient quantity of the product. However, the collective brand as a signal of quality is working only if strict rules and regulations are established. Otherwise, as evidenced by Carbone (1997), free riding behaviors are possible that lead to producing under the same brand products characterized by a low level of quality. The presence of established rules can help in assuring the consumer that the product has been obtained by means of compliance with these regulations and that, therefore, they comply with a given level of quality. Despite this, the firms that are producing under the same brand are interrelated between them. In fact the reputation of one of them depends on the others (Carbone, 2003), so the firms need to cooperate between them avoiding free riding behavior thus avoiding the occurrence of negative externalities that will needed be transmit to all the producers, if the low level quality food arrives to the final consumers (Carbone & Sorrentino, 2005).

2.3 The assessment of the qualitative attributes in the olive oil market

The olive oil consumption is undergoing a recent process of differentiation (Cabrera et al., 2015), due to the increasing consumer awareness about health and food safety issues. At the same time the preservation of the natural environment, as well of the culinary heritage, are becoming traits relevant to the consumers, as well as characteristics related to the sensorial sphere and those related to hedonistic and cultural aspects. For this reason it is important to understand in terms of differentiation strategy, which qualitative variables are able to affect the decision of the final consumers and consequently the value associated to each attribute. In light of the considerations, knowledge about how the qualitative cues are

evaluated by the final consumers becomes more and more important in order to increase the added value of EVOO, and differentiate the product with respect to the competitors.

This product for its own characteristics, has important *credence* and *experience* attributes. So, the choice of the purchase by the final consumers is based on several quality clues and for some of them the quality cannot be ascertained before the purchase. For example, for the consumers it is not possible to verify all the process that leads to the final product or the sensorial traits that characterize the olive oil. Linked to the characteristics of the product such as the nutritional and organoleptic characteristics, a growing attention is observed on those features related to the process such as the respect of the environment and tradition, authenticity and lack of sophistications. In this perspective the concept of quality cannot be referred to a single aspect, but different facets have to be considered. In the past, the consumers were careful only with the main categories of distinction of olive oil, such as extra-virgin, virgin and olive oil; more recently, olive oil started to resemble a differentiated product.

On this point, it is worth mentioning the distinction about the different forms of olive oil. The Olive Oil Council (IOOC, 2015) distinguishes olive oil in different categories based on the organoleptic and natural characteristics. These categories are described in detail in Fig. 13.

“Extra Virgin Olive Oil (EVOO): virgin olive oil which has a free acidity, expressed as oleic acid, of not more than 0.8 grams per 100 grams, and the other characteristics of which correspond to those fixed for this category in the IOC standard.

Virgin Olive Oil (VOO) virgin olive oil which has a free acidity, expressed as oleic acid, of not more than 2 grams per 100 grams and the other characteristics of which correspond to those fixed for this category in the IOC standard.

Ordinary virgin olive oil: virgin olive oil which has a free acidity, expressed as oleic acid, of not more than 3.3 grams per 100 grams and the other characteristics of which correspond to those fixed for this category in the IOC standard. This designation may only be sold direct to the consumer if permitted in the country of retail sale. If not permitted, the designation of this product has to comply with the legal provisions of the country concerned.

Virgin olive oil not fit for consumption as it is, designated **lampante** virgin olive oil, is virgin olive oil which has a free acidity, expressed as oleic acid, of more than 3.3 grams per 100 grams and/or the organoleptic characteristics and other characteristics of which correspond to those fixed for this category in the IOC standard. It is intended for refining or for technical use.

Refined olive oil is the olive oil obtained from virgin olive oils by refining methods which do not lead to alterations in the initial glyceridic structure. It has a free acidity, expressed as oleic acid, of not more than 0.3 grams per 100 grams and its other characteristics correspond to those fixed for this category in the IOC standard. This designation may only be sold direct to the consumer if permitted in the country of retail sale.

Olive oil is the oil consisting of a blend of refined olive oil and virgin olive oils fit for consumption as they are. It has a free acidity, expressed as oleic acid, of not more than 1 gram per 100 grams and its other characteristics correspond to those fixed for this category in the IOC standard. The country of retail sale may require a more specific designation.

Olive pomace oil is the oil obtained by treating olive pomace with solvents or other physical treatments, to the exclusion of oils obtained by re esterification processes and of any mixture with oils of other kinds. It is marketed in accordance with the following designations and definitions:

Crude olive pomace oil is olive pomace oil whose characteristics correspond to those fixed for this category in the IOC standard. It is intended for refining for use for human consumption, or it is intended for technical use.

Refined olive pomace oil is the oil obtained from crude olive pomace oil by refining methods which do not lead to alterations in the initial glyceridic structure. It has a free acidity, expressed as oleic acid, of not more than 0.3 grams per 100 grams and its other characteristics correspond to those fixed for this category in the IOC standard. This product may only be sold direct to the consumer if permitted in the country of retail sale.

Olive pomace oil is the oil comprising the blend of refined olive pomace oil and virgin olive oils fit for consumption as they are. It has a free acidity of not more than 1 gram per 100 grams and its other characteristics correspond to those fixed for this category in the IOC standard. The country of retail sale may require a more specific designation.”

Figure 13: Designations and definitions of olive oils . Source: IOOC Retrieved from:
<http://www.internationaloliveoil.org/estaticos/view/83-designations-and-definitions-of-olive-oils>

As pointed out by Cabrera et al. (2015), usually consumers (Fotopoulos and Krystallis, 2001; Sottomayor et al., 2010), especially from non-producer countries (Matthäus and Spener, 2008) are not aware about this fundamental distinction. This leads to misunderstandings about olive oil, where major quality features are not easy to assess. In fact, extra virgin olive oil (EVOO) is a natural juice of the highest quality olives obtained exclusively by mechanical and physical processes at low temperatures. EVOO is one of the most important elements of the Mediterranean diet and it has exceptional sensory and nutritional properties that provide a high value, in comparison to the other categories.

Despite the fact that olive oil is a differentiated product, for its own characteristics it is not easy to define which characteristics are able to have an influence on the price. Following the consumer approach theory, the main characteristics devoted to influencing the preferences of the consumers can be related to the intrinsic or extrinsic sphere. This

distinction is based on the evaluation of the product. The intrinsic characteristics are those related to the product itself, such as the olive variety, the colour, the place of origin, and the producer name, while the extrinsic ones to the features are not directly related to the product, but can influence the preferences (Orrego et al, 2012), such as the expert's grade. Starting with the *search* attributes acquired through the label and the observation of the bottle, as defined by Cicia et al. (2013), the appearance of the EVOO is an important aspect to be analyzed. As pointed out by Silayoi & Speece (2007), the packaging can be considered as a tool for communication. While the consumer is not convinced about what product to buy, he can base his decision on the packaging. The package can be seen as a value adding strategy, representing a sign of distinction and uniqueness. The package can reflect the quality perception about the product. As argued by Underwood et al. (2001) if the package represents a low quality product, this will be the impression to transmit to the final consumers. If the product has a low level of involvement in the optic of the consumers, the package is fundamental as it gives the first impression in the mind of the consumer. One of the main elements that characterizes the packaging for the case of olive oil is represented by the dimension. If the product is subject to repeated purchase, with low involvement and intended for household consumption, it may be preferable for the product to be sold in big packages and at lower prices. In the case of olive oil sold in the high-end market, the contrary occurs. There appears to be several studies that have focused on the impact of size and packaging on food choice. The majority of them (Baourakis & Baltas, 2003; Karipidis et al., 2005; Cicia et al., 2013) demonstrated an inverse relationship between the price and the size of the bottle. This can be explained by the fact that a small size of bottle is associated by consumers with a better quality of olive oil (Romo Munoz et al., 2014).

The material of the bottle is also important. The use of different materials depends on the production costs of the firm. To consider that, the smaller the size, the greater the costs for the producers (Wansink, 1996). Anyhow, the consumers seem to perceive olive oil sold in a plastic bottle (Cabrera et al., 2014) and in tin cans (Romo Munoz et al., 2015) of a lower quality associating a negative price premium. The preferences among the containers depend on the region of origin of the consumers and the buying habits. In the work of Di Vita et al. (2013), the consumers from the Northern-Central part of Italy prefer in the majority of cases buying glass bottles, while for the Southern part the percentages are more

mitigated. This can explain the different purchase habits among the consumers. The proximity to the production process in the Southern part makes it more profitable for the consumers to buy directly from the producers or the mill large quantities of olive oil in bulk and, hence the preferences for the size of the bottle result in differences compared to the preferences for the Northern-Central consumers.

In most of the studies only the use of the glass bottle is considered (Karipidis et al., 2005; Cicia et al., 2013; Carlucci et al., 2014). The glass properties for olive oil are excellent: it does not alter the organoleptic characteristics of the food and it is also recyclable and impermeable to gases and liquids (Lercker et al, 2015). The major drawbacks of glass are given by its fragility and heaviness, features that can also affect the cost of final products. In this perspective, in the study only the glass bottle will be considered. In the high-end market, the appearance is supposed to be a key factor for the product.

Another aspect related to the appearance sphere is the colour of the olive oil. The literature for this aspect is not vast. A recent study conducted by Errach et al. (2014), considering the Spanish olive oil market, found that for some of them the “colour-appearance” is an important driver decision. For Di Vita et al. (2013) the traditional consumers prefer the green to the yellow colour. Also in this case, the provenience of the consumers has to be considered, as well as the use of the olive oil, and the varieties of olives used.

The varieties of olives used for producing the oil may represent an important driver of the price decision. In relation to this specific aspect, in the study conducted by Dekhli et al. (2011) it was observed that the consumers that care about the olive varieties are those that considered the origin of the product the most important clue while buying olive oil. This idea is emphasized by Carlucci et al. (2014). In fact, if the varieties are indicated on the label, the associated price premium shows a positive value. Considering this, the olive varieties can be used as a tool of differentiation by the farms. In addition, the Italian consumers seem to be more dispositive to buy an olive oil produced with one variety. This is the result of a recent trend observed in the market as pointed out by Carlucci et al. (2014) and Cacchiarelli et al. (2015b).

The taste category represents the expression of the olive varieties as well as the climatic and soil conditions. The characteristics related to the tasting spheres are difficult to be recognized by the consumers; however, this clue represents an important aspect in their final decision. Differently for the other products, olive oil represents a product that

accompanies dishes, assuming the characteristics of a genuine seasoning. In this sense, depending on the dish a more or less neutral taste of oil is chosen.

The taste in terms of sensory profile can represent an important factor able to influence positively consumer behaviour purchases. Different studies showed the importance of this feature. As pointed out by Cicia et al. (2013), the sensory profiles of olive oil are different and richer compared to the past. In fact, the introduction of new techniques in the olive oil sector affected not only the production in terms of quantity, but also an increase in the quality, and as a consequence, the taste of EVOO. The consumers, thus, can find in the market EVOOs with different sensory profiles (bitter, fruity, ..). From the study of this attribute, in this work it is expected that the Italian consumers, due to the importance of olive oil in the Mediterranean diet and the strong existing link with tradition, are used to a medium-intense taste (given by specific olive varieties). However, in the mentioned work of Cicia et. al. (2013), using a hedonic price model, it was demonstrated that there is a discrepancy between the preferences of the consumers and the experts. In fact, the experts are led to prefer a strong taste, while the consumers are searching for an olive oil with a lower sensory profile. Since in this study, both attributes related to the taste category and the expert ratings are considered, it will be interesting see if this will also be the case. The sensory analysis for the EVOO, as underlined by Oreggia (2013), has been introduced recently, and the quality and the origin of the olive oil tasted can be ascertained following specific rules of taste, that include not only those operations established at the international level, such as the IOOC, but also the experience and the background of the tasters. In evaluating the sensory profiles the different level of experience among consumers has to be considered. As shown by Delgado & Guinard (2011) a bitter and pungent taste is not appreciated by Californian consumers, consumers that can be defined as “new” due to the fact that the consumption of olive oil is not rooted as much as for the consumers in the Mediterranean countries. The work conducted by Recchia et al. (2012) is in the same direction. On the other hand, the work of Caporale et al. (2006), focused on the perceived association for the consumers between the bitterness and typicality of the olive oil, demonstrated that for certain oils, strongly rooted in a specific region, a bitter sensory profile can be one of the most important descriptors of specific EVOO. Another important issue to be discussed is the indication of the aroma-taste in the label. Karipidis et al. (2005) showed that the indication of the taste in the label can have a positive influence on the

price. The recent work of Cabrera et al. (2015) has shown also that the degree of acidity is positively perceived by the consumers. In line with this study, the work by Romo Munoz et al. (2015) observed that the acidity level is an important attribute for EVOO importers.

In a differentiated market, characterized by asymmetric information, a crucial role of guidance and a signal of quality is represented by the expert ratings. In fact olive oil, as previously mentioned, has both search and experience features. The guide represents a tool for reducing the asymmetry of information between consumers and producers.

So a third party can assure about the quality of the product and help the consumers in collecting information about the good. Despite the importance of a third expert party with the role of guidance for the case of the olive oil, few studies were concentrated on this issue. Only recently, the role played by experts' ratings was considered a variable able to influence the price of EVOO (Cicia et.al, 2013), in which was underlined the preferences of the experts for olive oil with a rich sensory profile. Experts can help the consumers in collecting all this information about the sensory profile of each olive oil, and in all those features related to the farm and the processing method. Including simultaneously sensorial and objective characteristics, Combris et al. (1997) demonstrated that the jury grade, in the case of wine, represents one of the main attributes able to positively affect the price. Hay (2010) evidenced that the "*the judgment of experts strongly affects the final price of wine*". So the guides for wine and for EVOO can affect the decision to buy a product and the willingness to pay of the consumers. In the case of the *primeur* market the effect of the experts' grade is more evident. In this market, the wine is sold before being bottled. In this specific case, the status of the producers and the judgment given by the experts assumes an important role. The buyers at this stage of the wine process are not fully informed by the quality of the finished product. They can only have some expectation based on observable characteristics such as the grape variety (Bruwer & House, 2003) and the climatic conditions of the production season. The work conducted by Ali and Nauges (2007) demonstrated that the reputation and the *primeur* prices can be used as quality indicators by the consumers, as well as the expert rating (Caldas & Rebelo, 2013). A later study conducted by Ali et al. (2008) demonstrated in a more decisive way that the expert evaluation is one of the key drivers of the price. In fact, using as an example a particular case from 2003 when the expert ratings were given later in comparison to the publications

of the price in the *primeur* market, it was shown that the effect of the experts was able to increase the price of the better quality wine by on average 3 euro per bottle. The study introduced another important aspect in the field of the rating agencies. In fact, these works demonstrated not only the key role of the expert ratings, but the power of one of these so-called experts, Robert Parker (Cicchetti & Cicchetti, 2014). From the results of these studies it is possible to suppose that the reputation of the expert can be considered an important attribute in the hedonic price modelling, and as pointed out by Dubois & Nages (2006), it can also be over-estimated. In line with the previous finding, Cardebat & Figuet (2013) notice a significant effect on the expert ratings, but not related directly to the ratings given by Parker (Hay, 2010).

For olive oil, the role of the experts was not explored for two main reasons. Firstly, olive oil in traditional producers' and consumers' countries is sold in the local market or directly from the producers or from the mill. Secondly, for wine the use of expert guides is more frequent than for olive oil, due to the more rooted process of differentiation. In addition, some authors believe that for olive oil the preparation of expert guides every year can be repetitive and alienating work, especially because olive oil is not like wine, that is made in vintages (Caricato, 2014). In fact, for its characteristics olive oil has a short period of conservation. As evidenced by Oreggia (2014), olive oil after twelve-eighteen months becomes rancid. This period can be even shorter if olive oil is not preserved in dark bottles (this product is photo-labile), without avoiding all the thermal shocks.

Since recently, the features related to olive oil are dramatically increasing compared to the past, where the main distinctions about the product were represented by the category of the olive oil, such as the main distinction between extra-virgin, virgin and olive oil. A grade given by a third party can be used as a quality signal by the consumers. In the Italian case, in addition, there needs to be considered the fact that consumers are still buying olive oil directly from the producers. The guide can represent in this sense a qualified tool of promotion for the producers, especially in the small world of rural reality.

The use of expert ratings as an attribute able to influence the price has also received criticism. Castriota et al. (2012) suggested that the analysis, using the evaluation of experts, can have some weaknesses. In fact, the guide's ranking can be affected by two kinds of biases: generosity and personal preferences, even if the experts are working for the same guide that gives the evaluations and the ratings. In addition as pointed out by

Caderbat & Livat (2016), the expert judgment depends also on the nature of the analyzed good. For a good that has objective characteristics, the quality can be assessed in an objective way, otherwise the risk is to have a subjective evaluation. In fact for olive oil that has both subjective and objective features, is not easy for the experts to make a clear distinction and definition between these two spheres. This particular aspect was studied in several works for wine, dividing the researchers into two factions. On one hand, for the most famous wines a similar judgment given by different experts was found (Ashton, 2012) while for another the judgments seemed randomly assigned (Cardebat et al., 2014; Castriota et al., 2012) Another aspect to be considered is the expression and wording used by the experts (Ramirez, 2012). The sensory attributes are unique and finding appropriate words is hard (Peynaud, 1987). Sometimes, the language used for testing and describing the sensory properties is very esoteric and only professionals or experienced consumers can understand it. For understanding the taste note, the consumers must be able to have acquired a minimum level of experience. However, since the sensory characteristics are very difficult to define, only an expert is able to judge this (Ramirez, 2012). A positive review may create a positive image of the product able to guarantee a premium price and the shift in price elasticity of the demand of the product. This can be called the “*marketing effect of the note*”. The quality can be influenced in the long run by the marketing effect of the review. In addition, there is the possibility that wine with a higher price is more likely to receive a higher grade by the experts (Ramirez, 2012). To overpass these criticisms, Cicia et al. (2013) suggested using a blind test. In this way, the experts cannot be influenced by the reputation of the firm and the grade can be considered more reliable.

As a matter of sensory profile, as evidenced by Dinnella et al. (2012) there is also the problem that the olive oil is tested without considering the use that the consumers are making of the olive oil. In fact, as argued in the mentioned work, olive oil accompanied with two different products (in the specific case, tomatoes and beans) changes the sensory profile of the accompanied product, and hence the hedonic response of the consumers. However, this can be easily over passed since in the experts; guide, such as the Flos Olei, that will be employed in this study, the indication of the preferred dishes that can be accompanied to each EVOO is indicated.

As mentioned, the farms and all those characteristics related to the producers and to the production process are gaining importance. In a strongly segmented market, the final consumers can rely on the reputation of the farm and give attention to features related to the production process.

In the case of repeated purchase for experience goods, offered at a high level of quality, the reputation is established over time. So a producer of olive oil that wants to gain visibility in the market and attract new consumers has to maintain the quality of his product for more years. In fact, as already mentioned about the quality signal, the reputation for a high quality product is a strategic feature, defined by the economist as goodwill. As evidenced by Shapiro (1983) the reputation established represents common and public information and is the result of the past behaviour of the firm. At the same time, if a firm decides from one year to another to deviate from the offered quality it can easily lose the established reputation in favour of the competitors. In this term, the foundation year can have an important role in the definition of the price. As evidenced by Roma et al. (2013), the effect may not be clear, since it is true that older farms are likely to be more appreciated due to the acquired knowledge of the market. On the other hand, it has to be considered that young farms can be more disposable to new techniques of production and to explore new markets.

Few works in the field of wine have analyzed the role of farm size (Oczkowski, 1994; Landon & Smith, 1997) while for olive oil only a recent study conducted by Cacchiarelli et al. (2015b) considers the annual farm production of olive oil as indicators of farm size. As Oczowski (1994) demonstrated in his work, an inverse relationship between farm size and price exists. In the case of olive oil, as well as other agricultural commodities, this is due to the presence of economics of scope and scale. However, the relationship between the size of the producer and the price is more complex. In fact, on the one hand, it must be considered that larger producers can afford significant investments in promotional activities aimed at raising product reputation, as well as in R&D, which allows for innovations; both tend to have a positive effect on price. On the other hand, small size producers can be perceived as more traditional, genuine, and locally rooted, all features that tend to be associated with higher prices. Furthermore, as suggested by Roma et al. (2013), small production can be perceived as a synonym of exclusivity and this, again, can

have a positive effect on price. On the other hand, as underlined by Cacchiarelli et al. (2014b), big farms may have more money to invest in promotional activities and, as a consequence, for increasing the reputation on the market. From an economic point of view, a minimum production is needed in order to enter and gain visibility in the market. Since in the Italian territory, the small farms represent the majority, for them it is not possible to compete in terms of quantity, and therefore a form of cooperation is necessary to participate in the market.

In the literature, the cooperative can represent an opportunity for those farms that are too small to enter and survive in the market. Cooperation, in the field of olive oil, can also have a negative impact (Roma et al, 2013), especially in local and traditional reality, due to the possible free-riding behaviour of the producers, caused by decentralization in the decision making and absence of regulations. So it is possible to expect that cooperatives may sell at lower prices compared to others, due to the lower quality offered. In fact, the cooperative may be interested in selling their products to a low-medium segment of the market, following a strategy of minimizing the costs. In the recent work of Cacchiarelli et al. (2015b) for the medium-high segment of the EVOO market it was found that the cooperative, especially in the highest analyzed segment, suffers from a negative reputation, to confirm what was said before.

It is also possible that the cooperatives of smaller farmers, while big in terms of shareholders, are not interested, or for them it is not possible, to invest in promotion and advertising. Another problem of the local cooperative is represented by the strong individualism that characterizes the producers. So, for them, it is difficult to abandon the idea of individual reputation in favour of a collective one.

As argued by Erraach et al. (2014), the European Union in the last years has introduced some tools in order to promote food differentiation and the quality of the attributes of the product and to preserve the heritage culinary traits. In this way it is possible at the same time to offer high quality good and reduce the asymmetric information (Menapace et al., 2011) between producers and consumers, transforming the credence and experience features to search ones. The main role of the establishment of standards and labels is to provide information to final consumers linked to the certification, which in this way acts as a credible signal of quality.

A way to overpass the problem of absence of rule in a cooperation can be represented by the Geographic Indications system (GI) represented by the Protected Denomination of Origin (PDO) and the Protected Geographic Indication (PGI) (EC Regulation 510/06)

The GI system was introduced by the European Union with the EC Reg. 2081/82 as a tool for linking the area of origin to the quality of the product through the preservation of the food heritage and the local culinary traits. In an asymmetric market, with non-homogeneous products, the presence of the Indications of Origin can represent a tool of vertical differentiation of one product from another in terms of quality. This is even more true for the case of olive oil. The presence of a third party certifier can increase the information available for the consumers and prevent free riding behaviour (Carbone, 1997). The regulation system of the GIS may help all those small farms to enter in a market with entry barriers and establish a collective reputation through the use of a common brand (Carbone & Sorrentino, 2006). This product is therefore at risk of being adulterated, so the adoption of the GI standard can protect the reputation of this product from fraud. In fact, the adoption of the EU's GI stems from food security issues and preservation of the food heritage. As underlined by Menapace & Moschini (2012) the adoption of the GI standards can be perceived as a signal of quality in the agro-food market, since the collective reputation derives directly from the certification that assures the consumers of a minimum level of respected requirements assuring the credibility of the signals of quality. Another aspect needs to be evaluated: production under GI, as argued by Masini (2012), can protect the producers that respect the established conditions, from the risk that third parties may improperly use the name of the product. In this optic, the GI adoption can give an advantage with respect to the competitors, linking the reputation to the heritage and historical tradition of a specific place.

However, in the literature the topic has been receiving little attention compared to other aspects, with contradictory results about the effect on the European Certification of Origin on the consumer price premium. This can find an explanation in the low use of GIs. In the Mediterranean countries, olive oil is sold in most cases in the informal market, based on the direct contact between the producers and the consumers. These kinds of channels are more appropriate and effective as a quality assurance. Because of this, especially in the local market, consumers may not be willing to pay a higher price for the GI product, as

they hardly perceive it differently from the local one that is more frequently bought (Carbone & Sorrentino, 2005).

Since the certification of quality represents an efficient differentiation tool in the food market, as Bramley et al. (2009) has evidenced, the adoption of the Geographical Indication can represent an opportunity for producers to achieve market niche and extract higher willingness to pay (WTP). In fact, for Italian consumers, as argued by Van der Lans et al. (2001), the PDO labelling is perceived as a quality indicator, able positively to influence preferences. As pointed out by Scarpa et al. (2005), the PDO label shows to be much more effective for olive oil than for other agricultural products such as oranges and table olives.

The work of Santos & Ribeiro (2005) underlined the positive impact on the price formation of olive oil. In the specific case the presence of the PDO certification was able to have an effect of about 30% on the price premium (PP). The results of the work of Cicia et al. (2013) show that all the attributes related to the spheres of the geographical origin, such as area of origin, presence of GIs and bottling place, guarantee a higher premium price compared to the other groups of variables. A positive effect was found for EVOOs sold in retail chains (Ribeiro & Santos, 2004) or in e-commerce shops (Carlucci et al., 2014), while for the data collected in the main supermarket chains (Cabrera et al., 2015) the GI recognitions do not play a significant role in the formation of the price. In support of this, it has to be noted that the EVOOs with the GI label have limited availability in the supermarket, especially in the producer countries. A recent survey conducted by ISMEA (2012) revealed that in the Italian supermarket the presence of the PDO olive oil, compared to extra virgin olive oil, is quite scarce. The same result was obtained in the studies of Aprile et al. (2012), van der Lans et al. (2001) and Karipidis et al. (2005).

It should also be mentioned that a discrepancy of preferences among the PDO and PGI certifications may also be found. The PDO certification is related to a product that is produced, processed and prepared in an established area, while for the PGI, the geographical link is linked to at least one of the mentioned stages.

As evidenced by Deselnicu et al. (2013) for olive oil, the PDO scheme, which is more complex compared to the PGI, is preferred due to the strong requirement that assures a higher price premium. The work conducted by Menapace et al. (2011) demonstrated that for Canadian consumers of olive oil, that can be defined as new consumers, there is a clear

preference for the PDO certification instead of the PGI. At this point it is worth mentioning the heterogeneity of the consumers that buy olive oil (Scarpa & Del Giudice, 2004; Krystallis & Ness, 2005; Aprile et al., 2012). Preferences among consumers differ across countries for cultural, historical, religious and culinary reasons. Olive oil, for its link to the history of the Mediterranean countries, represents a product that is strongly rooted to the habits of these countries. Krystallis & Ness (2005) using a conjoint analysis demonstrated that the decision to buy olive oil with a certification of origin depends on age, level of education and income. In purchases, opportunities differ from those related to the classic household expenditure, as in the case of holidays, as shown in the recent work conducted by Sabbatini et al. (2016a): tourists from non-traditional countries, such as those from Northern Europe, with a higher level of income and educational level, prefer to buy local products, including, in most cases, olive oil. In particular, regarding geographical indications, Scarpa & Del Giudice (2004) using a choice experiment model found that the preferences for buying olive oil with GI depends also on the region of the provenience. As regards this issue, the Italian consumers seem to be particularly sensitive to the place of origin of the product, that brings important considerations about the quality of the product (Carbone et al., 2014), but the preferences can differ among the area of origin. In particular, the consumers coming from the South of Italy prefer to buy more olive oil from the same area, and in bulk (Di Vita et al., 2013) compared to consumers from the Northern part. The main reason can be found in the fact that the highest number of producers and mills is concentrated in the Southern area of Italy. The olive oil, different from other agricultural products, such as wine, is bought once per year, by the consumers in informal markets, so the trust relationship is a driver of the choice of the consumer. For the Southern consumers, the proximity to the production facilities makes it more suitable to buy local olive oil. Carlucci et al. (2014) underlined that the impact of the Geographical Indication is strongly linked with the location of the farms. In fact, if these two attributes are considered together, as shown, the price premium was related to different locations. The work conducted by Aprile et al. (2012) evidenced another important aspect related to the awareness about the PDO-PGI scheme and organic farming. If the consumers receive information about these kinds of labels, they tend to prefer the PDO product, compared to the others, otherwise they rely more on the extra-virgin olive oil indication. The lack of awareness about the different distinctive signs of quality has been analyzed in several

studies (Verbeke, 2005; Privitera & Platania, 2004). First of all, in the market there are many signs of quality which in some cases differ little between them, creating confusion for the final consumer (Carbone & Sorrentino, 2004), especially in the case of the perceived differences among the PDO and PGI designations. It should also consider the improper use of the GIs by non-certified and unrecognized companies. The fact is frequently verified for olive oil. As often mentioned olive oil can be adulterated and sold as a typical product, taking advantage of the reputation of the original product.

Linked to the presence of the Geographical Indications of the olive oil, the effect of geographical location is also an important attribute that needs to be considered, in order to evaluate if for the consumers of high quality EVOO these two aspects are related between them, or if one of the two are likely to emerge.

Many authors have concentrated attention on the role played by reputation in terms of perceived quality related to the place of origin. The relation between food product, heritage and place of origin has been known since the past. As evidenced by some authors such as Easingwood et al. (2011), the region creates a combination of characteristics that make a product unique. These products are able to guarantee to the consumers characteristics such as genuine, quality and differentiated quality (Broude2005). Similar to previous studies on the application of the hedonic price model, such as Schamel & Anderson (2003), Carlucci et al. (2014), Cabrera et al. (2014), and Cacchiarelli et al. (2015b), the place of origin of each EVOO is considered. Due to the different composition of the Italian territory in terms of climate and soil, but also in terms of tradition and history, the origin of the product is extremely important, not only for a quality point of view, but also in relation to the EVOO itself. In fact, the origin of the EVOO is able to differentiate the product, due to the huge amount of varieties of olives (in Italy 500 are counted) and the climate of the country. The origin clues can give the consumers some hints about the olive oil's taste features (Del Guidice et al., 2016). In addition, the link between the product and geographical origin is fundamental for the traditional consumers. As pointed out by Aprile et al. (2012), the origin labelling can be used as a tool not only for linking the area of origin to the quality of the product, but also for connecting the production area to a particular technical rule (Menapace et al., 2011). In previous literature (Van der Lans et al., 2001; Fotopoulos & Krystallis, 2002; Krystallis & Ness, 2005, Dekhili et al., 2011) the origin is the main clue in the olive oil purchase decision. It is important to mention the work of Santos & Ribeiro

(2005) that demonstrated that when consumers cannot make a distinction about olive oil based on intrinsic characteristics they rely on the origin as a quality index. It is interesting to mention the recent work of Romo Munez et al. (2014): for imported EVOO, the consumers are interested in the origin of the product, such as in the case of the study, where the attributes gave the highest price premium.

An important attribute considered in different studies for olive oil is represented by organic farming. The EU Reg. No 834/2007 defines organic farming as “*an overall system of farm management and food protection that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes*”. So, organic production refers to a technical process and not to the product itself. Established clear labelling rules at the European level, as evidenced by Canfora (2012), can be seen as a tool for reducing asymmetric information and the distance between consumers and producers, avoiding any improper use of the organic label; at the same time they can be perceived as a signal of quality. The quality signal of the organic production, following the rules established at the European level, is extremely important for the consumers, since in contrast to the *search* and *experience* characteristics, the quality cannot be ascertained by the consumers, neither before nor after the purchase. In this case, the signal of the producers is not sufficient and credible to reducing the information gap, and a common label can provide all the necessary information leading the consumers to choose based on their preferences. At the same time, this way of running a farm can be perceived by the consumers as a way of preserving the environment and reducing the pollution (Sottomayor & Monteiro, 2010).

In the literature regarding the case of Italian olive oil, the results obtained by Scarpa & Del Giudice (2004), Aprile et al. (2012), Carlucci et al. (2014), and Cicia et al. (2013) showed that the organic claim has a positive impact on the price. However this effect is lower than the results coming from the presence of the geographic indication. As argued by Delmas et al. (2016), it may be a possible trade-off between organic farming and offered quality. In fact, the producers of organic products in order to abate the impact of the production, may sacrifice the quality of the product. At the same time it has to be considered that organic

production is subject to a reduced content of pesticides (Caswell, 1998), so this may not be true. As underlined by Sandalidou & Baourakis (2002) the satisfaction of the consumers while buying organic olive oil depends of the health criterion, while the weakness point is the availability in the supermarket and the information and advertising issues.

On this point, the heterogeneity among the consumers has to be considered. Consumers with a higher income and level of education demonstrated a preference for organic and certified products while buying high quality olive oil. However, the local origin attribute tends to prevail (Aprile et al., 2012; Costanigro et al., 2014), especially in the case of olive oil (Scarpa et al., 2005). Recent studies such as the work conducted by Bazzani et al. (2015) demonstrated that the preferences for local and organic food depend not only on the socio-demographic characteristics, but also on the personality traits of the consumers. The finding of this study underlined that the consumers more inclined to experiencing new situation were those that preferred the local and organic claims.

Another aspect that can be considered as a *credence* attribute is represented by the harvesting method. However, this aspect in the literature for olive oil does not receive attention. As mentioned in the work conducted by Dekhli et al. (2011), since for consumers it is not possible to evaluate the quality before the purchase (Shapiro: 1983), consumers rely more on extrinsic characteristics such as brand, production method and presence of certifications of origin, with respect to the harvesting method that is related to a previous stage of the production process.

In this study, variables able to have an impact on the price are considered. Since this specific aspect is not considered in the literature, it will be interesting to observe if the consumers prefer the natural method of harvesting as synonymous of quality, in terms of preservation of the tradition, or the mechanical ones, as found in the recent work conducted by Cacchiarelli et al. (2015b).

2.4 The hedonic price model

Since the turning point of Lancaster contribution in Demand Theory, the attention of economics has shifted from the product as such, to the attributes that define it..According

to this approach, the characteristics of the product are considered relevant in the decisions that lead to choose among products. In other words, every product meets certain requirements depending on the specific characteristics that it has. The utility for the consumer derives not from the use of the good, but from the appreciation of the characteristics of the good itself. As a result, consumer demand is not addressed to a good as such, but in the basket of features that sets it apart (Lancaster, 1966). The combination of characteristics possessed by the goods on the market is a key element of competitiveness. So, the consumer in evaluating a good, takes into account the features offered and if they respond to their needs.

As posed by Lancaster (1971), the rational consumer he chooses the product that maximize his net utility as follows::

$$u_{ik} = b_{i1} c_{k1} + \dots + b_{in} c_{kn} - p_k$$

Equation 1: Net utility of the consumers

The net utility for the consumer i derives from the product k , is given by the evaluation of the characteristic n for the good k , net the price p_k . This approach considers any kind of quality feature where attributes can be classified according to different criteria including horizontal and vertical differentiation. The main advantage of this approach is given by allowing for empirical estimates of consumer demand in that performs better compared to the traditional ones. In fact, while evaluating the cross-elasticity, as noticed by Cabral (2002), the bundle of the considered features can be considered for each product, avoiding the estimation of each variety of product as a separate good.

The consumers are careful not only about the product but also the characteristics that compose that product. This approach is true in many cases especially for the agricultural product. The quality of a product depends on different features: nutritional and process attributes, package, food safety issues, among others. So the idea that a product is evaluated as such by the consumers is not more feasible. In this case, a discrepancy among the preferences of the consumers may happen. For this reason an approach that evaluated products as a bundles of characteristics is more useful.

For its own characteristic, olive oil is particularly suited to the investigation regarding the influence of different factors on olive oil price and how the quality is evaluated by consumers.

The literature on the factors that affect olive oil price is quiet vast. Traditionally attention was concentrated on the consumer side and willingness to pay (WTP). In the past, different methodological approaches that tried to study the preferences among consumers employed discrete choice models (Caracciolo et al, 2013), with particular attention to Conjoint Analysis (Jiménez- Guerrero et al., 2012) and the Random Utility Model (Finardi et al., 2009), in order to detect which features are more important for the consumers (Del Giudice et al, 2015). Other important studies in this field used experimental analysis (Delgado & Guinard, 2011), multi-criteria analysis (Sandalidou et al., 2002) or analysis based on the study of the sensory profiles of the olive oil (Caporale et al., 2006; Delgado & Guinard, 2011). Recently, there has been a growing interest in the study of the attributes liable to influence the oil price with the use of the hedonic price method (Karipis et al., 2005; Cicia et al., 2013; Carlucci et al., 2014; Cabrera et al., 2015; Romo Munoz et al., 2015; Cacchiarelli et al., 2015b).

The theoretical developments of the hedonic price model are based on the work of Rosen (1974), that is recognized as the founder of the application based on the underling theoretical idea. Following the Lancaster approach, Rosen reneges by the concept of “indivisibility” of the product (Tirole, 1988). So, the price of a product is not the result of a simple addition of each characteristic, but the product can be ideally decomposed into its characteristics, and a market value can be attributed to those features, since the price is a function of different and measurable attributes. In fact, while the product is differentiated, it is difficult to understand the demand and supply conditions only by observing the price in the market.

This model was employed in the past in different fields characterized by highly differentiated products, with attributes that are not easily defined by the majority of the consumers, for example as in the automobile industry (Matas & Raymond, 2009). It was also used to study how consumers appreciate environmental characteristics in terms of

implicit price (Tagliaferro, 2005; Limehouse, 2010), or to evaluate noise reduction (Day et al., 2007).

The first raw application in the agricultural market was proposed by Waugh in 1928 for asparagus¹⁴, with the aim to discover which attributes consumers appreciate more, and to transmit this information to the producers. Then in 1974, Rosen demonstrated that in market equilibrium, an implicit or shadow price can be associated to the features related to the product.

As argued by Unwin (1999) one of the critical factors of the hedonic price approach is the perfect competitive market assumption. This point was addressed by the pioneer of the hedonic price approach. Rosen (1974) pointed out that if the price does not derive from a competitive market, it can be derived from the consumer preferences, since the utility of the consumers derives from the appreciation of the features of the good, and not from the state of the market. In addition, the model has been applied with success in the case of a monopolistic market, such as the case of the Swedish wine market (Nerlove, 1995) or the imperfect market characterized by a non-homogeneous product (Karipidis et al, 2005, Cabrera et al., 2015). In the case of imperfect competition, the implicit prices can be affected by the market power of the producers, price elasticities and demand for the good (Hassan, and Monier-Dilhan, 2006). Despite this, even if a case of a monopoly is faced (Nerlove, 1995), the preferences expressed by the consumers can be taken into account by the monopolist that wants to guarantee his market power overtime. The application of the model is not influenced by the state of the market, since with specific econometric tools, as evidenced by Thrane (2004), it is possible to deal with this issue.

Another criticism addressed to the model is that the independent variables mostly refer to the supply side. According to Combris et al. (2000), the implicit price of each attribute represents the value assigned by the consumers to each specific attribute and so, from a long-run perspective, it can represent the minimum price at which the attributes can be sold or purchased (Karipidis et al., 2005), since the marginal price associated to each attribute in the long term will be the same across all the firms. Many studies for wine (Combris et al., 1997; Roma et al., 2012) and olive oil (Karipidis et al., 2005; Cicia et al., 2013; Carlucci et al., 2014; Cabrera et al., 2015; Cacchiarelli et al., 2015b) have used both

¹⁴In his work, Waugh observing that the prices in the Boston wholesale markets were different across asparagus regressed price with selected characteristics discovering a clear relationship between the price and the quality factors such as color, size and uniformity of spears.

objective sensory attribute traits, to make inferences on consumer preferences. The main point is recognized by the predictive approach of the model. In addition, as pointed out by Oczowski (1994) and Schamel, 2003), implicit prices cannot be considered only as an expression of consumer preferences, but also from a demand side perspective (Okzowski , 2001; Schamel, 2003; Rosen, 1974). Producers tailored their goods according to the desire expressed by the consumers, and in exchange, they receive a revenue as an intermediate in the market. It has to be considered that since with hedonic price analysis it is possible to know the implicit price associated to each attribute considered in the study (Brombun & Sumner, 2003) this can be compared to a reduction of costs that the producers could incur by implementing different production and promoting strategies. So, hedonic price modeling can be seen as a tool to decide on a new strategy of marketing, as for example in the case of expanding in a new market (Carlucci et al., 2014).

Furthermore, the point of applying a hedonic price approach is not to understand how the market is working, but to try to assess the role of different quality clues in the price formation.

Another point regards the fact that the consumers that buy for the first time a product with experience attributes are not aware of all the characteristics involved in the price formation, and so, models may not be useful in studying the first-time consumer preferences. It has to be considered that recently, the consumers show interest in buying high quality products, such as in the case of wine and EVOO. These kinds of consumers are really careful and aware of all the information available on the market, often using expert guides as a tool to overpass the asymmetric information problem. In a certain way, this explains the recent success of the guide. Furthermore, due to the predictive approach of the model, it is possible for the consumers to understand which variables are able to influence price formation positively or negatively, and to change the future price formation, since EVOO consumers can be considered to be price-influenced.

In cases such as the study of Cicia et al. (2013) the expert grade, and not the price, is considered as an independent variable. For some aspects the expert grade can be seen as an endogenous variable and so, not eligible, like the dependent ones. The hedonic price approach does not give precise indications about the distinctions between explanatory and

dependent variables, but the predictive power of this method (Okzowsky, 1994) can allow for the use of Rosen's basic idea of in a different way.

Recently this method has been largely used for food products like wine (Bicknell et al., 2005; Benfratello et al., 2009; Roma et al., 2013; Cacchiarelli et al., 2014; Cicia et al., 2013; Costanigro et al., 2010), coffee (Maietta, 2005; Schollenberg, 2012; Teuber & Herrmann, 2012), eggs (Karipidis et al., 2003), and cheese (Schröck, 2014).

Despite the importance of the olive oil sector in the agricultural market, in terms of production and exportation, few studies have been conducted applying the hedonic price model to the Italian EVOO market (Carlucci et. al, 2014, Cacchiarelli et al., 2015b).

The olive oil market is getting more diversified and this product is losing its connotation as a commodity and basic everyday life condiment. The process is also pushed by the increase in the international trade of olive oil, with consumers from non-traditionally producing/consuming countries that are increasingly interested in this product and in some cases consider it, to some extent, as a hedonic or even as a *luxury good*.

In contrast, the hedonic price model was especially applied by many authors for wine. The results help to shed light on this complex market. Wine for its own characteristics faced the differentiation process before olive oil. In a certain sense, wine can be associated with extra-virgin olive oil, due to the similar attributes that are affecting the decisions of the final consumers. In fact, both products have some experience and credence features. In general terms, it can be noticed that the results obtained from hedonic pricing for wine are similar to those for olive oil. For this reason they will be frequently retrieved for this product.

CHAPTER 3:

MATERIALS AND METHODS

3.1 Definition and estimation of hedonic pricing models

In this chapter attention will be paid to an explanation about the methodological research process, illustrating firstly the hedonic price models and the functional forms that can be used. Then a brief description about the panel data analysis will be given, distinguished between random effects and fixed effects models. Finally a discussion about the target and the sample population will be addressed and a description about how the variables are built will be shown.

In order to understand which attributes are able to influence the price of extra-virgin olive oil, in this study a hedonic price model has been used. As already mentioned, the model is used for differentiated goods, and recently with success for agricultural products.

Firstly, as suggested by Benfratello et al. (2009), let's consider two goods that are the same, except for one attribute. If consumers assign a value to this attribute, the difference in the price can represent the willingness to pay more, *ceteris paribus*, for this specific feature. In fact, using hedonic price modeling it is possible to calculate the contribution of each attribute in the formation of the price of the good, since a product can be considered as a bundle of attributes evaluated separately from the consumers (Carlucci et al., 2014). The market good can be represented as a vector of k attributes as follows:

$$z = (z_1, z_2, \dots, z_k)$$

Equation 2

while the utility function referring to the consumers can be expressed as follows:

$$U = U(z_1, z_2, \dots, z_k; \alpha)$$

Equation 3

where z_k represents the quantity of the kth attributes of the market good and α is used as a parameter of the consumer's preferences. The level of the kth attributes reached by the consumers depends on the quantity Q_i consumed. X_{jk} represents the amount of the Kth attributes existing in one unit of the Jth good. Based on these assumptions it is possible to rewrite z as:

$$z_k = f_k(Q_1, Q_2, \dots, Q_n, X_{1k}, X_{2k}, \dots, X_{nk})$$

Equation 4

So, the individual level of utility can be represented as:

$$U = U(Q_1, Q_2, \dots, Q_n, X_{1k}, X_{2k}, \dots, X_{nk})$$

Equation 5

As demonstrated by economic theory, the consumer will maximize the utility equation, taking into account the budget constraints, represented as follows:

$$M = \sum_{j=1}^n P_j x_j$$

Equation 6

where P_j is the price reported for the good jth . The solution of the maximization of the function is represented by the following function:

$$P_j = f(x_{j1}, x_{j2}, \dots, x_{jk})$$

Equation 7

The prices associated to each attribute are not expressed directly in the market, but with hedonic price modelling it is possible to evaluate the contribution of each one to the formation of the price. The implicit prices are assigned by the consumers to the product's attributes, based on their evaluation. The observed prices of differentiated products can be seen as determined amounts of features associated with them.

3.2 The hedonic price functional form

In the hedonic price models, as pointed out by Romo Munoz et al. (2015), two factors are likely to influence the results: the functional form and the variables selected. There are no specific guidelines in economic theory about which is the best functional form to be used, so the choice depends on empirical investigation (Brentari & Levaggi, 2009). Different functional forms and different variables have been most frequently used in the hedonic analysis performed in the literature, and the kind of variables used are presented.

Economic theory does not specify the most preferable functional form to use. The model specification was carried out by analyzing the previous literature on this subject. It is observed that for equation 7, the most common functional specification forms are expressed in linear (Santos & Ribeiro, 2004; Karipidis et al.: 2005), logarithmic (Tamer et al., 2009) or semi-logarithmic forms (Schamel, 2003; Benfratello et al., 2009; Romo Munoz et al., 2014; Cacchiarelli et al., 2016).

The previous hedonic price equation (equation 7) can be written in several functional forms as follows:

$$p = \beta_0 + \sum_{j=1, \dots, N} \beta_j X_j + \varepsilon \text{ (Linear)}$$

Equation 8

$$\ln p = \beta_0 + \sum_{j=1, \dots, N} \beta_j X_j + \varepsilon \text{ (Log - Linear)}$$

Equation 9

$$\ln p = \beta_0 + \sum_{j=1, \dots, N} \beta_j \ln X_j + \varepsilon \text{ (Log - log)}$$

Equation 10

In the linear model, the implicit prices, associated to each attribute, are constant. The implicit prices are those that are associated to each product characteristic, and so, contribute to the price formation (Rosen, 1974). In fact the implicit prices are estimated by regressing the product price on its attributes. This means that the consumers are free to set

the composition of the attributes based on the individual preferences and the additional price of one variable is independent of the amount of attributes used (Cabrera et al., 2015). The linear form equation permits a clear analysis of the attributes that are important for the consumers and, additionally, supports the retailers and the processors to develop the product differentiation strategy in accordance with the preferences of the consumers (Karipidis et al., 2005). However this functional form received criticism since it was observed that the relation between the price and the quality is hardly linear, and the hypothesis is especially strong in the case of the inclusion of dummy variables in the model.

The most used functional form in hedonic price research is the log-linear. As evidenced by Benfratello et al. (2009), it is preferable to use a logarithmic form when the goal is to build an objective-reputational model. This kind of model considers not only those characteristics related to the product and directly observed but also those related to the quality spheres and measured by the expert grades. The interpretation of the estimated coefficients is easier in the case of the logarithmic form since the percentage change in the price is explained by a unit change in the independent variable. The dependent variable represents the logarithm of the range when the price falls. In addition, in this way it is possible to transform the dependent variable in order to approximate to a normal distribution (Schröck, 2014).

In analyzing the effects of the coefficients, they are interpreted as a percentage change in the price variable, in association with a unit change in the independent variable. For the continuous variables, the percentage is expressed as:

$$(\exp^{B_j} - 1) \times 100$$

Equation 11

while for the dummy variable the percentage variation can be expressed as:

$$100 \times (\exp^{[B_m - 0.5 \text{Var}(B_m)]} - 1)$$

Equation 12

In addition, the log-linear specification allows obtaining normally distributed residuals.

Summing up, the main advantages in using a logarithmic form are: i) it is possible to mitigate the effects of the outliers; ii) it allows for deriving the elasticity (Ramirez, 2010); iii) this specific functional form can give a better control of possible problems of heteroskedasticity (Schamel & Anderson, 2003).

The best choice between the different available functional forms (linear, semi-logarithmic and double-logarithmic) can be done with the help of different tests. As suggested by Oczkowski (1994), in order to choose the functional form that is more suitable, it is useful to apply the Regression Equation Error Test (RESET). This test helps in understanding whether the correct specification form is used, as it tests the adequacy of the specified model (Carter Hill et al., 2011). However, the test does not indicate which form is the best one to choose, as the null hypothesis is that the original model is adequate and so, there is no option for misspecification.

One more test used by Cabrera et al. (2015) is called the “Voung test”, based on the comparison between the predicted probabilities of two models. In this way it is possible to exclude the model that does not fit the available data.

In the past, the hedonic price models were estimated using OLS regression; more recently new methods such as quantile (Cacchiarelli et al., 2015b) and interval regression (Cacchiarelli et al., 2015a) have been used. These particular forms are employed in order to establish whether the relationship between the price and quality characteristics of the product change at different price levels (Costanigro et al., 2010). With quantile regression it is possible to investigate the possible change at different points in the distribution (Koenker & Basset, 2007; Buchinsky, 1998). In this case the change among a specific market segment can be investigated.

The interval regression is indicated in all of the cases when the prices are expressed in ranges or in ordinal categories, in order to try to comprehend exactly at which point the price is changing (Long & Smith, 2006; Cacchiarelli et al, 2014b).

3.3 Panel data analysis: fixed and random effects model

Since in this study, data covers several consecutive years, a panel data analysis, besides the annual OLS estimations, was also conducted. In this section a brief description about the panel data driven approach will be given.

In the case of repeated observations on a cross-section, and in the presence of a balanced panel where the time period is the same for each cross-section data, with the panel data analysis it is possible to study the behaviour of the considered entities across time (in our case the entities are EVOOs and the producing farms). Usually this technique is used in social science, for repeated surveys for a large number of individuals analyzed for a short time period.

The main advantages are: i) observing a sample in a temporal dimension; ii) getting information about past attitudes of the analyzed units; iii) reducing less *collinearity* among the variables; and, last but not least, iv) increasing the size of the sample, and as a consequence the obtained estimations (Gujarati D.N., 2004; Hsiao, 2007).

In addition, panel data help to keep under control the so- called “individual heterogeneity” which means that individual/specific characteristics (Gujarati D.N., 2004) are not directly observed in the model, such as differences in farm practices or regulations (at European and national level), which are not possible to observe and measure in the OLS regression. These kinds of models are also suitable when there are variables at different levels of analysis (e.g.: regions, macro-areas, countries, and so forth). Otherwise these factors could cause bias due to omitted variables.

Coming to the way these models are specified, first of all it is important to clarify some basic aspects. A panel can be considered short or long. A short panel considers many individuals, for a short time period, while in the long one the contrary holds. A panel data analysis needs to have at least 3 time periods. Otherwise, it is suggested to carry out only the OLS regression for each available year (Carter et al., 2011).

Before illustrating the different models, it is worth writing the equation for the unobserved effects model (Wooldridge, 2010), which is as follows:

$$Y_{it} = \beta X_{it} + \alpha_i + u_{it}, t = 1, 2, \dots, T$$

Equation 13

where:

c_i ($i = 1, 2, \dots, n$) is the unobserved component or heterogeneity;

Y_{it} is the dependent variable where i represents the unit that changes across t time;

X_{it} represents one independent variable;

β_1 is the coefficient associated to the X_{it} variable; and

u_{it} indicates the error term or idiosyncratic disturbance that changes across i and t .

The simple case is represented by the pooled OLS regression, where the panel structure of the data is ignored. In this case, it is assumed that the error term is: $\varepsilon_{it} \sim i.i.d. (0, \sigma^2)$, so there is no serial correlation among the observations. In this way, each observation comes from a different individual, ignoring the fact that each unit is presented with reference to several moments of time. If the sample is very small, this can be accepted, otherwise the estimations will be biased. For this reason it is important to consider the panel data structure.

The data considered in the study has a structure in which the observations are nested within farms. In this particular case, the observations related to each farm unit can be non-independent. The estimations of these kinds of observations, with an Ordinary Least Squares Method, including year dummies, lead to uncorrected and biased estimations. The suggested method to handle unobserved characteristics is represented by the fixed effects (FE) and the random effects model (RE).

In this paragraph the techniques for the fixed effects and the random effects models for panel data are briefly discussed, based on the extension of the pooled OLS.

3.3.1 Fixed effects model

The fixed effects (FE) model is used when the interest is in studying variables that differ over time. In fact each farm has its own identity and characteristics that can influence the predictor variables.

With this model, it is possible to capture all those aspects related to a particular individual that do not vary over time. Variables such as the geographical origin vary over the individuals but not over time. Removing all the time-invariant variables allows us to study the net impact of the variables on the dependent variable. Every individual has a different intercept than a different coefficient α_i in the regression model, causing translation in the regression line. This model is referred to as *fixed* due to the fact that each individual intercept does not vary over time (the intercept captures the so-called fixed variables), but it may vary across the individual (in this case the farms). In this case, the intercept varies for each farm, but the slope coefficients are constant across the units.

An important assumption is that the time-invariant characteristics should be related to each individual, and so not correlated with the other entities. Every individual has its own characteristics, and hence its own error term and the constant (that assimilates the differences) should be not correlated with the others.

The fixed effects equation appears as follows:

$$Y_{it} = \beta_1 X_{it} + \alpha_i + u_{it}$$

Equation 14

where:

α_i ($i = 1, 2 \dots n$) is the unknown intercept for each individual;

Y_{it} is the dependent variable where i represents the individual and t the time;

X_{it} represents one independent variable;

β_1 is the coefficient associated to the X_{it} variable; and

u_{it} indicates the error term.

In the case where the model also includes binary variables, it shall be written in the following form:

$$Y_{it} = \beta_0 + \beta_1 X_{1,it} + \dots + \beta_k X_{k,it} + \gamma_2 E_2 + \dots + \gamma_n E_n + u_{it};$$

where:

Y_{it} is the dependent variable, i represents the individual and t the moment of time;

$t = 1, 2, \dots, T$;

k represents the vector of the explanatory variables;

X_{it} represents the independent variables, the vector of k explanatory variables Y_{it}

β_k is the coefficient associated to the $X_{k,it}$ variable

E_n is the individual n , so in the models $n-1$ individuals are also included; and

u_{it} indicates the error term

The fixed effects model is appropriate when the differences between individuals can be reasonably considered as translations of the regression line, e.g. in the case where the sectional sample of individuals represents a representative sample of the reference population.

One drawback of the fixed effects models is the fact that it cannot be employed to analyze the effects of time-invariant factors. The fixed effects model, in fact, is only used to analyze the within-variability referring to the same individual.

3.3.2 Random effects model

The random effects (RE) model differs from the fixed effects one, since the variation across the individual is assumed to be random, and hence not correlated with the dependent variable.

One of the main advantages is represented by the fact that it is possible to include time-invariant variables, that in the previous one were included in the intercept.

The random effects equation appears as follows:

$$Y_{it} = \beta X_{it} + \alpha + u_{it} + \varepsilon_{it}$$

Equation 15

In the random effects model it is assumed that the error term linked to each individual is not correlated with the dependent variable, so the time invariant variable can also have a role in the regression. The differences among the analyzed units refer to the individual error term, not the intercept (Park, 2011).

The random effect estimators can be seen as a weighted version of the between- and the within-(fixed effect) estimators. The weight average is given by the fact that both variations are combined within the same unit over time as well as the variation among the individuals in a specific time.

When the time span is long there are no significant differences among the random effects and the fixed effects estimations. Differently, when the contrary holds, the results can differ. If the cross-section units are randomly collected, the random effects model fits better; however it first has to be investigated with appropriate tests.

If the selected sample is extracted from a much larger population (so that the sample may not be representative of all the characteristics of the population), it might be appropriate to consider the individual effects in the sample as randomly distributed effects in the sample of individuals.

For choosing the most appropriate panel model two main tests are suggested by the literature (Gujarati D.N., 2004; Wooldridge, 2010). To begin with, the Breusch–Pagan Lagrange multiplier can be performed for testing the random effects model. In detail, this test is used for understanding whether there is individual heterogeneity, and to decide between random and pooled OLS regression. The null hypothesis is that the variance across the unit is equal to zero. If the alternative hypothesis is accepted, it is possible to conclude that the random effects models can handle better heterogeneity than the OLS pooled estimation.

Secondly, in order to decide which model fits better to the available database, the Hausman test (Gujarati, D.N., 2004) can be performed. With this test it is possible to compare the random effects model with the corresponding fixed one. If the null hypothesis of non-correlation among the individual effects and the other regressors cannot be rejected, a random model effects is preferred. In the contrary case, the fixed effects model performs better than the random one. In fact, if the explanatory variables are correlated with the error term, the random effects model gives biased estimations.

3.4 Target and sample population

The data needed to apply this method to the case of olive oil can be found in different sources such as shops (Karipidis et al, 2005; Cicia et al., 2013), main supermarket chains (Ribeiro & Santos, 2004; Romo Munoz et al., 2014; Cabrera et al., 2015), and websites (Carlucci et. al., 2014), as seen in the previous chapters. For the purpose of this study we used a different source of information: an expert guide. In Italy we are witnessing a recent interest in expert guides as a way of promotion and dissemination for extra virgin olive oils. This goes in parallel with a tendency to the evolution of perceived quality features in the agro-food markets, where the concept of quality perception is not limited to the characteristics of the final product but keeps all aspects of the production process from the production to the consumption, such as fairness in the distribution of profits along the chain, as well as environmental impact risks (Galli, 2009).

The reasons are many: first of all, experts' guides offer a variety of data that are not easy to collect otherwise; secondly, the sensory evaluations can be regarded as much more reliable since the experts are qualified and have a deep and sound knowledge of the market. In addition, in this way it is possible to include in the analysis attributes such as those pertaining to the producers, which cannot be observed just by collecting data directly from the retailer and/or in the outlets. To the writer's best knowledge, there is only one recent study conducted by Cacchiarelli et al. (2015b), that uses an expert's guide for the estimation of hedonic price modeling applied to a medium-high segment of the EVOO market. The guide represents an important tool in order to estimate the implicit price for olive oil quality attributes.

All the data used in this study are gathered from the “FLOS OLEI” guides for three consecutive editions: 2013, 2014 and 2015. Here, the 2013 edition refers to the 2011/12 production year, the 2014 edition includes data about 2012/13 EVOO production, and so forth.

For the purposes of this study this guide has been chosen as it is the only Italian olive oil guide that refers to the highest market segment, which can be defined as the niche for excellence in the EVOO market.

Secondly, the chosen guide covers extra-virgin olive oil farms from Europe and different parts of the world, and a leading EVOO guide in Italy. For each selected product, the guide presents information about the olive growing farm, supplying historical and cultural information, as well as production data. Overall, 47 countries are reviewed, among which Italy and Spain are analyzed more in detail and are subdivided into regions. The majority of the other countries reviewed are European (Croatia, Portugal, Slovenia), while, among the remaining ones it is worth mentioning Morocco, Tunisia and Turkey. High levels of quality can also be found outside of conventional oil production areas, so the guide includes farms coming from South America, Brazil, Australia, New Zealand, Japan and South Africa. For every edition, an official panel of Expert Tasters selects about 500 producers, and for each one only one EVOO is selected and reviewed. The farms and relative EVOOs can be included in the guide for more consecutive years, allowing for panel data analysis.

This guide represents the richest one in terms of observations and attributes reported. In fact, alongside the product's attributes are present information about the farm and the production process and about the geographical origin. This relative abundance of information is crucial in the hedonic price approach where the capability to explain prices relies strongly on the number of attributes for which data are available.

The market studied can be defined as a high-end segment since in the FLOS OLEI guide EVOOs are not rewarded which cost less than 6.00 €/Lt.

Consumers to which the guide is addressing are not only oil lovers, but also those operators along the supply chain such as gourmet shops, buyers, importers, distributors, technicians, and sales website. In fact, this guide, compared to others (such as Slow Food), is not available in libraries. Olive oil is a product that due to its characteristics is susceptible to fraud, so conscious consumers are turning to high-quality products to be guaranteed about

the quality offered by the product. In this context the guide represents a way to overpass the lack of information and promote all those producers that decide to produce a higher quality product. Guides can also be a means to arousing curiosity and interest in typical and traditional products.

Moving on to analyzing the guide in detail, in addition to detailed information on the best productions, the guide sets out an array of useful information, technical data and cartographies (Morosi M., 2013). For each farm and the selected EVOO an information cards presented, as shown in Fig. 14.

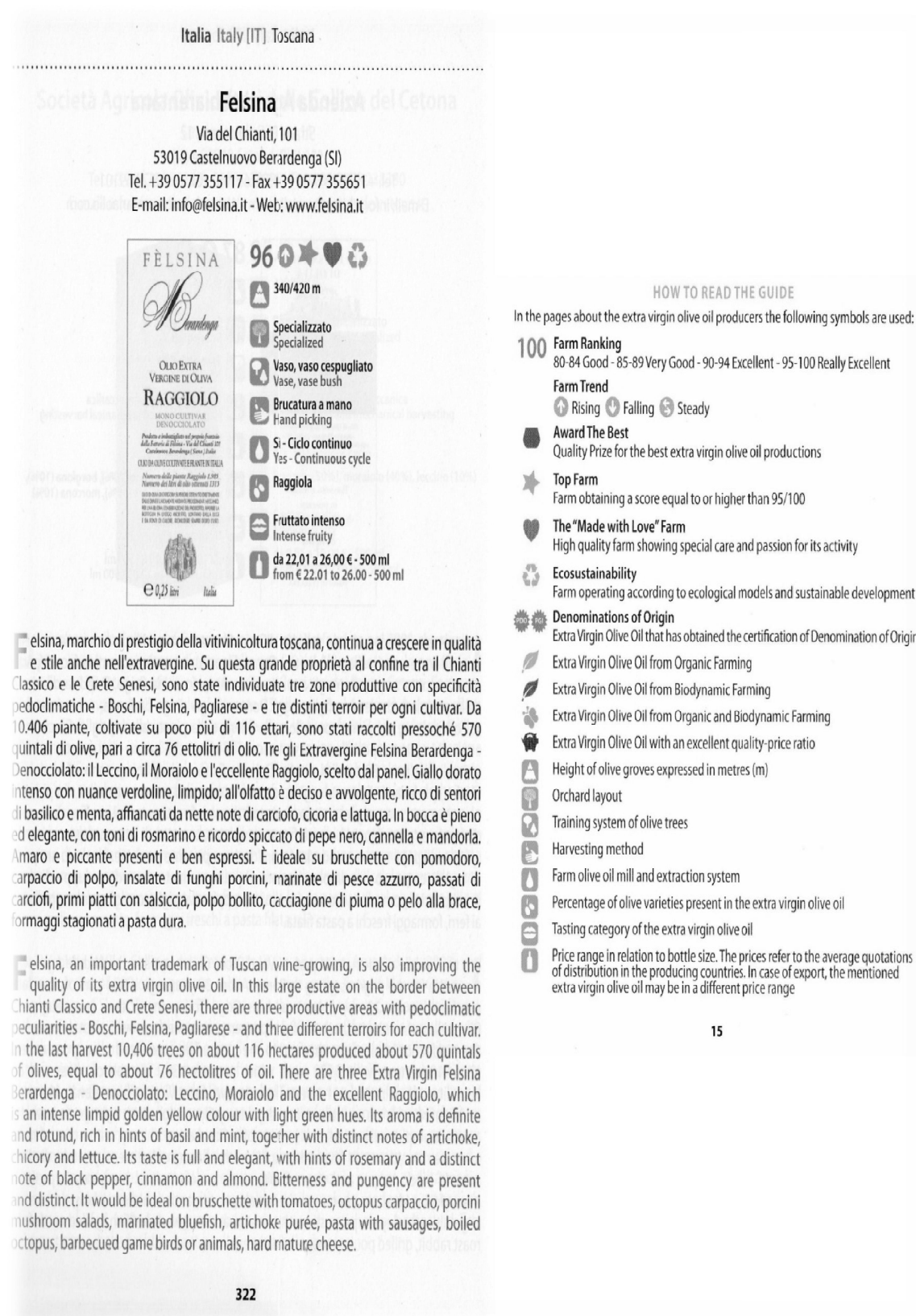


Figure 14. Example of farm and olive oil review, with the symbols used. Source: FLOS OLEI 2015 (2014)

Each farm presented in the guide is associated with a numeric score, called the Farm Ranking. For each farm only one olive oil item is selected even if the farm supply is diversified and includes several labels and/or different specific lines of production. The “Farm Ranking” is a score ranging from 80 to 100. The guide does not provide a review of EVOO below the score of 80. In relation to this, the guide distinguishes four point scales: the first running from 80 to 84 (Good); the second from 85 to 89 (Very Good); the third from 90 to 94 (Excellent) and the fourth from 95 to 100 (Very Excellent). The evaluation is given taking into account several factors that refer to the entire production of olive oil and to the farm. In detail, the experts are considering the quality of the olive oil valued, the business continuity of quality, an economic value calculated based on the quality/price ratio and the presence of a farm oil mill. Higher values are given to the farm with an onsite mill, with the goal of rewarding farms which directly produce their own olive oil (not a third party) from their olive trees. Those farms that process olives in the onsite mill are rewarded, in order to distinguish them from industrial producers. The general aim rewards all the aspects of the production process and not only the selected EVOO. In this way, the consumers can have more information about all the aspects concerning the production of the olive oil and, thus they can have all the information about the aspects that cannot be detected only by looking at the final product (the so-called credence and experience attributes).

Alongside the farm ranking, each farm included in the guide is awarded with other prizes according to a wide set of features indicated with a symbol, near the grade given by the experts. First is the economic situation of the farm in the considered year (rising, steady or falling). The first of these prizes is called “Award the Best” and is conferred to those companies that have stood out from the others for the high quality of their production. In addition, if the farm receives a score greater than 95, it is awarded with another prize called “Top Farm”. There are also other prizes: The “Made with Love” farm, assigned for all those companies that demonstrate a passion and special care for their business. The “Eco-sustainability” prize is given to farms operating according to ecological models and sustainable development. Other information given with symbols refers to the olive oil. In the guide it is indicated whether the olive oil has received a EU Geographical Indication, which is divided into Protected Denomination of Origin and Protected Geographical Indication. It is also reported if the EVOO is coming from organic or biodynamic farming.

EVOO is also designated for its excellence in the quality-price ratio, assigned to those olive oils that are sold with lower prices (value range 6.00- 8.00 €/Lt), and that received at least one of the other awards given by the experts.

On each technical sheet, on the upper part, all the information about the farm is indicated, such as the personal contact, which may be useful to the readers (municipality, address, region, phone number and website).

Most of the reviewed Italian farms, in the three reference years, are located in the Center of Italy (57%), followed by the Southern (31%) and the Northern (12%). This picture does not represent exactly the geographical pattern of the Italian olive oil production units (ISTAT, 2016). Most of the farms are located in the Southern area (70%), followed by the Central (27%), while the Northern part of the Country has the lowest concentration of production (3%). This stems from the fact that in this study, it is considered important to analyze the quality and the excellence of the EVOO. The distribution in terms of reviewed farms reflects the production of the olive oil among the different areas of Italy. While the South is specialized in selling big quantities, often in bulk, the premium EVOOs are produced in the Central-Northern part of the peninsula.

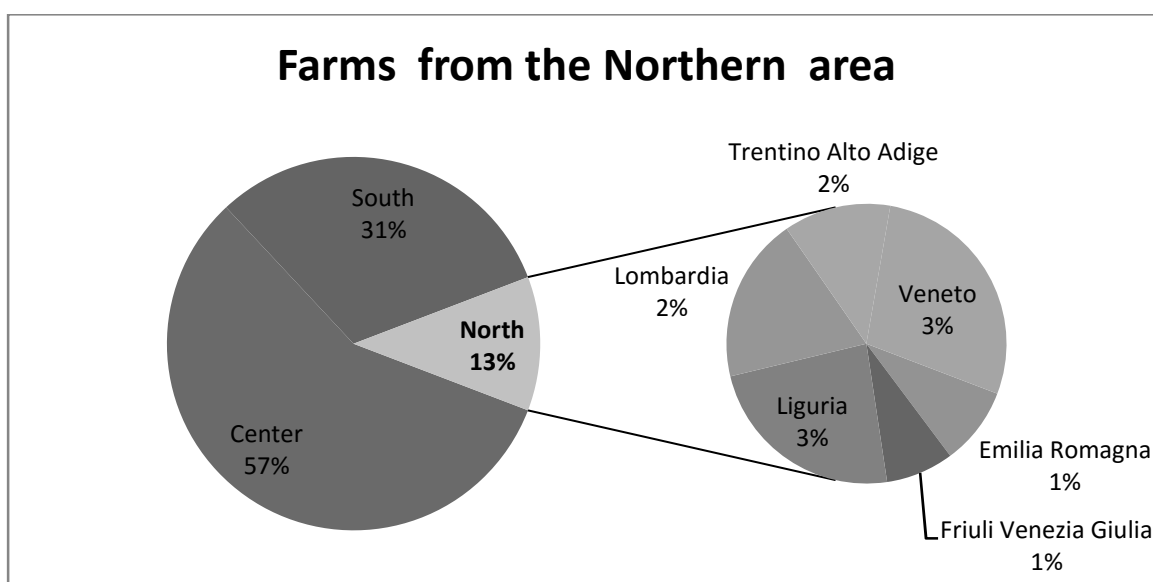


Figure 15. Percentage of farms from the Northern part of Italy. Author's elaboration. Source: FLOS OLEI

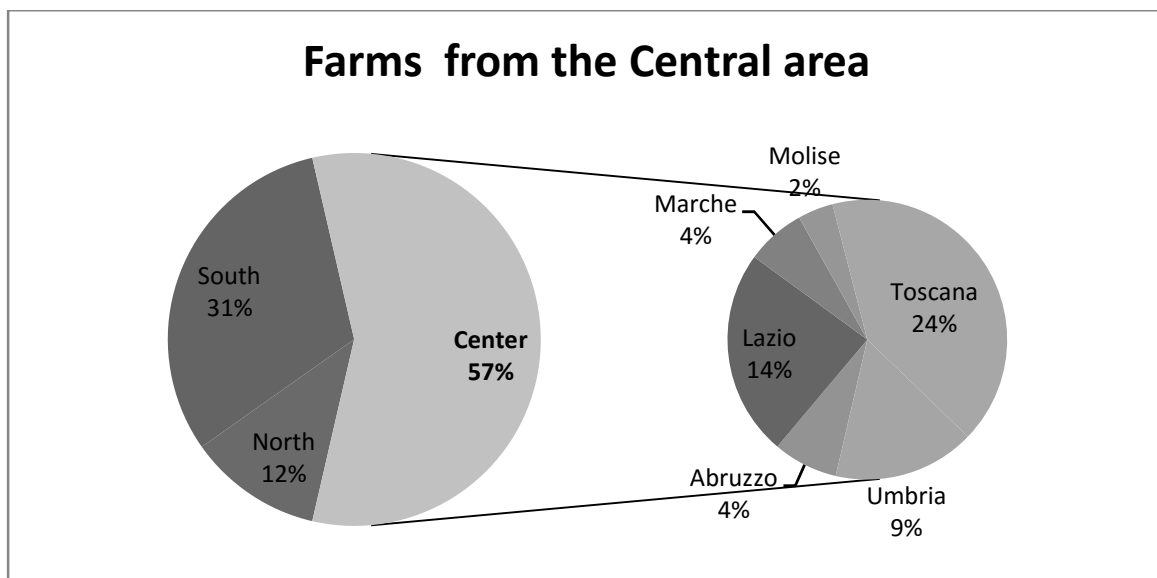


Figure 16. Percentage of farms from the Central part of Italy. Author's elaboration. Source: FLOS OLEI

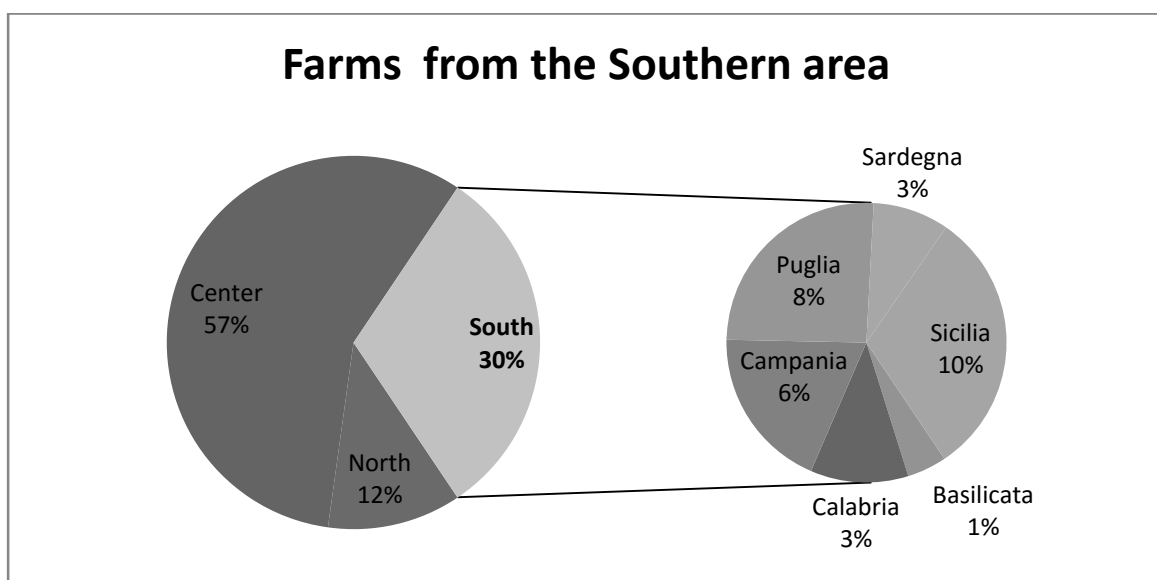


Figure 17. Percentage of farms from the Southern part of Italy. Authors elaboration. Source: FLOS OLEI

In the sample not all of the Italian regions are considered. For example, Piedmont is not present in the guide; however this region has a small olive growing area of 31 hectares (Istat, 2016). Some regions such as Puglia, Calabria and Sicily (the major producer of olive oil in Italy with 53% of Italian farms that produce olive oil) have few farms reviewed. Conversely regions such as Lazio, Umbria and Tuscany are overvalued compared to the

data related to the number of production units. In detail, Tuscany, in terms of farms, represents one fourth of the total reviewed farms in the guide (23,4%), while in terms of share over the total national population of farms it is only 6%, and in terms of quantities produced it is even less representative, with a quota of about 2% (INEA,2015). This depicts the particular market segment reviewed by the FLOS OLEI guide that refers to the excellence of the EVOO market. As a consequence, the representative sample is clearly reflecting the quality production of extra virgin olive oil, and this segment is well represented in Tuscany, with a worldwide outstanding reputation.

It is also worth noting that the analyzed farms are larger than the national average. In a general perspective it is interesting to compare this data with the general data once proposed by the Italian Institute of Statistics. The data collected from the 6th General Census of Agriculture (6° Censimento Generale dell'Agricoltura) shows a mean value of the olive oil farm of 1, 25 Ha (hectares), with differences in the distribution. In fact 47% of Italian farms specializing in the production of olive oil have less than 2 Ha, while 28% have more than 10 Ha. In FLOS OLEI the farms in this dataset differ in size, with a range from 1 to 800 Ha. 19% of the farms have a size below 5 Ha, and 57% from 5 to 30 Ha. The remaining 24% has a size larger than 30 Ha. Fig. 18 shows farm size per macro area, and highlights that the farms reviewed are bigger than the entire population. In fact 56% of the farms in the sample have an area dedicated to olive growing of more than 10 Ha, while at the national level this percentage decreases to 24%.

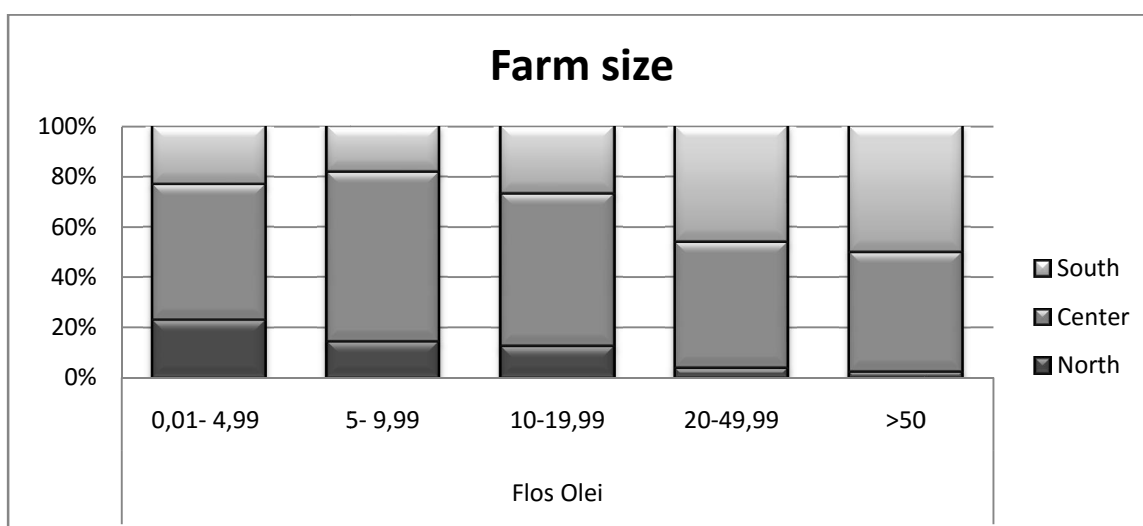


Figure 18. Farm size categories. Author's elaboration. Source: FLOS OLEI

For each oil the label of the selected EVOO is present, together with the aforementioned symbols for further information about the production process, such as the height of olives groves expressed in meters, the orchard layout, the training system for olive trees, the harvesting method, the farm olive oil mill (if present) and the extraction system.

The orchard layout refers to how the olives are planted, which can be specialized, promiscuous (the land where the olive trees are planted is used also for crops that are planted between the rows of the trees), or a mix of categories.

The training system refers to the geometric shape chosen, with the purpose of expanding the foliage of the olive in relation to the force that the climatic conditions allow it, to distribute in the space the leaf apparatus for a good illumination. The geometric shapes in their exemplification are grouped into: vase forms (polyconic vase, jar upside, bush shaped); globe; monocone; mixed forms: polyconic; and monocone.

The extraction system refers to the mechanical methods to extract oil from the olives. There are two main different mechanical methods to extract oil from the olives. The first is the traditional method and it is the same that was used since ancient times, ie the crushing of the olives with large granite grindstones followed by extraction of the oil by pressure. The oil press system with "continuous cycle" derives from the fact that it consists of a combination of machines connected in continuity between them, which excludes any interruption in processing, and so guarantees a high quality. This method in the reviewed farms is used in most of the cases (99%). This method improves the quality of the oil, enhances the body and the aroma of fruity oil, and improves the storage of oil because the polyphenols, which are excellent natural oxidants, are not dispersed in the wastewater. The third extraction system is known as *Sinolea* and the first steps of the processing are identical to the "continuous cycle". The advantage of the *Sinolea* method is determined by the fact that the system works completely in the cold and carries out the extraction of natural dripping "drop by drop" based on the physical principle of the different surface tension between oil and vegetation water.

The harvesting methods refer to the method of collecting the olives. In FLOS OLEI it is indicated if the olives are collected in the traditional way of hand picking and beating or by mechanical harvesting. Hand picking is a way of harvesting with the use of small branches, while beating refers to the practice of beating the tree branches with a stick until the fruit

falls. With mechanical harvesting vibrations able to separate the olives from its stalk are used.

Alongside, the information related to the product, such as the varieties of olives used, the tasting category and the price range in relation to the bottle size, are also indicated.

The Italian varieties of olives included in the FLOS OLEI guides are 82. For each variety the percentage of use in the olive oils has also indicated. If the olive oil is *mono-cultivar*, that means it is produced with only one variety of olives, and is reported in the label present in each informative sheet.

The tasting category refers to “*the olfactory and taste aromatic intensity* “ (FLOS OLEI 2014, pp. 22) of the EVOO and is divided into three groups: light, medium and intense taste, depending on the degree of the perceived sensations, and strongly depending on the olive varieties.

The prices, reported in intervals, refer to the mean quotations of distribution in the country of origin, not indicating the price when exporting. The prices are expressed in twelve ranges, in relation to the bottle size.

The bottle size considered in FLOS OLEI are: 250 ml, 500 ml, and 750 ml. The 1 litre bottle size is not considered, which differs from other Italian expert guides such as “Slow Food” (Cacchiarelli et al., 2015b).

For each EVOO and farm analyzed in the guide, a brief description is given about the production process as well as the food pairings. Mentioned also is the other EVOOs produced, even if not selected. The colour and the EVOO accompaniment are also offered to the readers.

Regarding the information about the farms, the foundation year and the hectares and trees owned are given, as well as the entire olive oil production, expressed in terms of quintals of olives produced and purchased, and in terms of olive oil farm production expressed in hectares.

3.5 FLOS OLEI selected variables

In order to implement a panel data analysis, a panel of the farms and their characteristics was created for three consecutive years.

To track the farms over time the name of the farms as well as the region of origin was used, in order to minimize the possibility of erroneous matching.

Overall, the built dataset consists of 402 farms. Of these, 44% are reviewed only for one year, 21% for 2 years and 35% for three consecutive years.

The built dataset allows to obtain information on different attributes of the EVOO, which have been grouped into three main categories: attributes related to the product, features related to the farm and to the production process, and those related to the geographical origin. Most literature in the hedonic price model applied to the olive oil sector has been concentrated on characteristics such as brand (Ribeiro & Santos, 2004), sensorial and objective characteristics (Cacchiarelli et al., 2015b), reputation, presence of the certification of origin (Carlucci et al., 2014), and expert grade (Cicia et al., 2013). On the other hand, another part of the literature has focused on the influence of the distribution channel (Romo Munoz et al., 2014) and the market segmentation (Karipidis et al., 2005). To the best knowledge of the author, none of them explore all these features simultaneously, and over time.

It is important to mention that the division into three groups is not rigid, as there may be some overlaps. In fact, the awards given by the experts refer both to the farm and to the olive oil. For example the variety used is by definition an intrinsic attribute of the olive oil, but some are characteristic of a particular place, so in a certain way it can be considered as peculiar for that place.

Some of the attributes were excluded *a priori* from the study for lack of observations, and hence, not enough degree of freedom: foundation year, extraction method, and the “Award the Best” mention. The “EVOO with excellent quality-price ratio” variable was excluded due to problems of correlation with the dependent variable and to avoid potential problems of endogeneity.

Other variables such as the height of olives groves expressed in meters, the orchard layout, and the training system of olive trees were excluded because they were not pertinent to the study of the price formation of the olive oil.

The variables refer to *Coratina*, *Frantoio*, *Leccino*, *Moraiolo* and *Pendolino* varieties, grouped into national varieties, to consider their possible impact on the price formation compares to the local varieties. In this way it was also possible to increase the degree of freedom.

A Spearman's correlation test was run to assess the relation between the "Farm Ranking" and other variables related to the different awards assigned by the experts, such as the "Made with Love" farm and "Eco-sustainability" award. This test was selected since, in the case of outliers, it is more reliable than others. In this way the presence of outliers does not interfere with the results of the correlation test, especially in the case of a monotonic relationship between the variables analyzed.

<i>Spearman's Correlation</i>			
	Farm Ranking	"Made with love farm" Award	"Eco-sustainability" Award
Farm Ranking	1		
"Made with love farm" Award	0,75	1	
"Eco-sustainability" Award	0.17	0,16	1

Figure 19: Spearman's correlation. Author's elaboration.

Spearman's correlation shows a positive correlation between "Farm Ranking" and the "Made with Love" award, so this variable was excluded from the study.

The region of the farms was excluded to avoid the problem of correlation with the macro-area and GI variable. Due to the fact that the PGI recognition is present only in Tuscany, it will be not distinguished between PDO and PGI recognitions.

Others variables such as the farm size as well as the trees and hectares were excluded for their problem of correlation with other variables, such as the annual production of olive oil which was included as well the macro-area.

In this work three different levels of attributes were considered. The whole set of variables, for each farm, and selected for this study, is included in Tables 1-3 below.

Table 1. Variable description: Price and product attributes

<i>Variable</i>	<i>Variable description</i>
Price	The price is expressed in seven intervals from 6 to 65 Euros/liter. For each range the mean value is taken and it refers to the 1 liter bottle size.
Product attributes	Variable description
Tasting category	The tasting category is made by the experts. The categories are 3: 1) light; 2) medium; 3) intense. There are three binary variables for each taste, equal to 1 if the EVOO belongs to the category; otherwise 0.
Size of the bottle	Size packaging: 250 ml, 500 ml and 750 ml. There are three binary variables for each bottle size equal to 1 if the EVOO belongs to the category; otherwise 0.
Varieties per farm	Total varieties per farm, divided in 4 ranges: 1) 1 variety; 2) 2 varieties; 3) 3- 4 varieties; 4) more than 5 varieties. There are four binary variables for each range of varieties, equal to 1 if the EVOO belongs to the category; otherwise 0.
Local and National Varieties	For each EVOO the varieties used for making the EVOO are indicated, distinguished at the national and local level. There are two binary variables for each level, equal to 1 if the EVOO belongs to the category; otherwise 0.

Author's elaboration.

Table 2. Variable description: Farm and production process attributes

<i>Farm and production process attributes</i>	<i>Variable description</i>
Farm	Name of the farm. An ID number is assigned to each farm.
Cooperative	Dummy variable, equal to 1 if the farm is a cooperative; otherwise 0.
Production(hectoliter)	Annual production of EVOO in hectoliters, divided in 5 categories: 1) <35; 2) 36- 135; 3) 136- 235; 4) 236- 335; 5) >336. There are five binary variables for each category, equal to 1 if the EVOO belongs to the category; otherwise 0.
Purchased olives (quintals)> 50%	Annual purchasing of olives per farm. Binary variable equal to 1 if the percentage is > 50%; otherwise 0.
Farm ranking	Continuous variable measuring the expert ranking, from 80 to 100.
Farm ranking(90-94) and 2 year presence	Binary variable equal to 1 if the farm was rewarded with an excellent score (90-94) and present for two consecutive years (2013 and 2014).
Top farm (95-100) and 2 year presence	Binary variable equal to 1 if the farm was rewarded with a top farm score (95-100) and present for three consecutive years (2013 and 2014).
Farm ranking(90-94) and 3 year presence	Binary variable equal to 1 if the farm was rewarded with an excellent score (90-94) and present for three consecutive years (2013, 2014 and 2015).
Top farm (95-100) and presence 3 years	Binary variable equal to 1 if the farm was rewarded with a Top farm score (95-100) and present for two consecutive years (2013, 2014 and 2015).
Eco-sustainability Award	Farm operating according to ecological model and sustainable development. Dummy variable equal to 1 if the award is assigned; otherwise 0.
EVOO from organic farming	Organic production. Dummy variable equal to 1 if the EVOO is made from organic production; otherwise 0.
Harvesting method	The method of harvest is divided in 3 ranges: 1) hand picking and beating; 2) mechanical harvesting. There are two binary variables for each category, equal to 1 if the EVOO belongs to the category; otherwise 0.
Farm olive oil mill	Presence of private olive oil mill. Dummy variable equal to 1 if the mill is present; otherwise 0.

Author's elaboration.

Table 3: Variable description: Geographical Origin

<i>Place of origin and EU certification attributes</i>	<i>Variable description</i>
Macro areas	Location of the farms, only for Italy. Three macro areas are discerned: North, Center and South. There are three binary variables for each category, equal to 1 if the EVOO belongs to the considered area of origin; otherwise 0.
Region	Region of provenience. Binary variables were built for each region, equal to 1 if the EVOO belongs to the considered region; otherwise 0.
Geographical Indications (GIs)	Dummy variable equal to 1 if a Geographical Indication (PDO or PGI) is present; otherwise 0.

Author's elaboration.

3.5.1 Prices

Firstly, in this study, the dependent variable is represented by prices declared by the producers reviewed in the guide. The prices of the EVOO originally were indicated in twelve different intervals referring to different bottle size: 250 ml, 500 ml and 750 ml. For the regression, the prices have been grouped into six different categories, as can be seen in Fig. 6. Later, the average price for each interval was considered and for comparing these prices, all of them were transformed, taking as a reference the 1 litre bottle size. The mean price is 23.00€ per litre, with a wider range of prices from 6€ to 65€. In detail, the prices are concentrated in the medium range from 15.00€ to 27.00€ (60%). The lowest price ranges (range from 6€ to 15€) represent 22% of the sample, while the higher price intervals (between 27.01€ and 65 €) count for 18%.

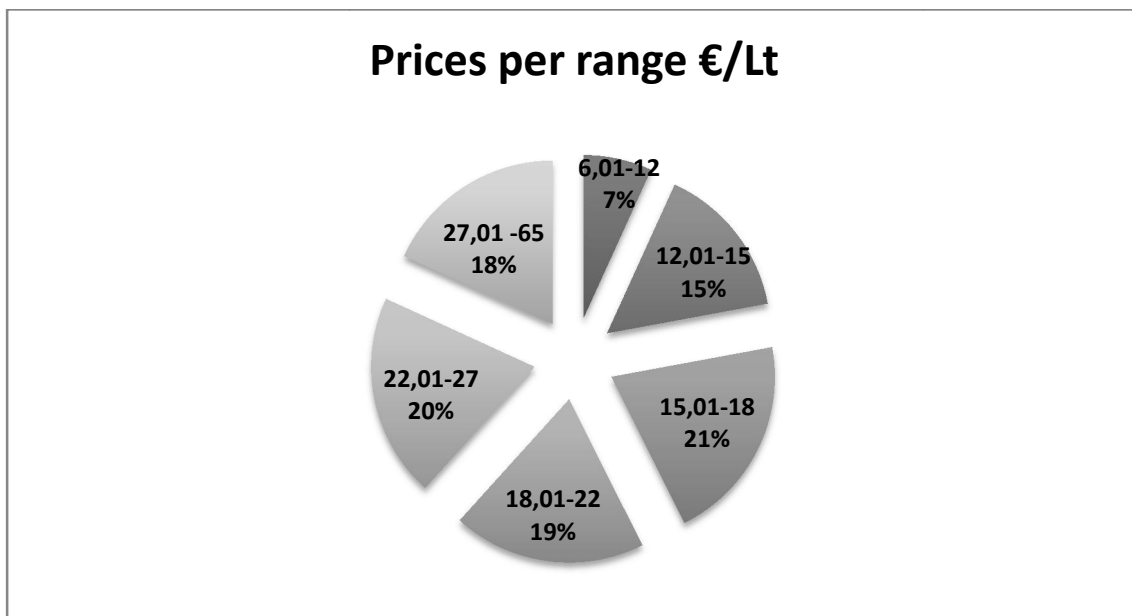


Figure 20. Price range in relation to bottle size of 1 liter. Author's elaboration. Source: FLOS OLEI

It should be noted that the average prices are higher than the average prices of the olive oil of the market which in the three considered years is on average about 4.00€/liter (Ismea, 2016). This is reasonable, since in this study, the high-end segment of the EVOO market is considered. However, research on a website that sell high quality EVOO suggests that the observed prices are close to those collected in this study. For example, looking at the website of EATALY (<http://www.eataly.net/>), the prices referring to different bottle sizes are in the range of 6€ to 65.00€. Examining the €/liter ratio, there are cases where olive oil is sold for 100€ /Lt. The same is observed in the recent study conducted by Cacchiarelli et

al. (2015b). In the mentioned work, for the medium-high segment of the olive oil market, the observed average price was about 18 €/Lt.

Regarding prices during the three considered years, it is observed that the prices in the lower ranges had a drop in favour of the higher ones.

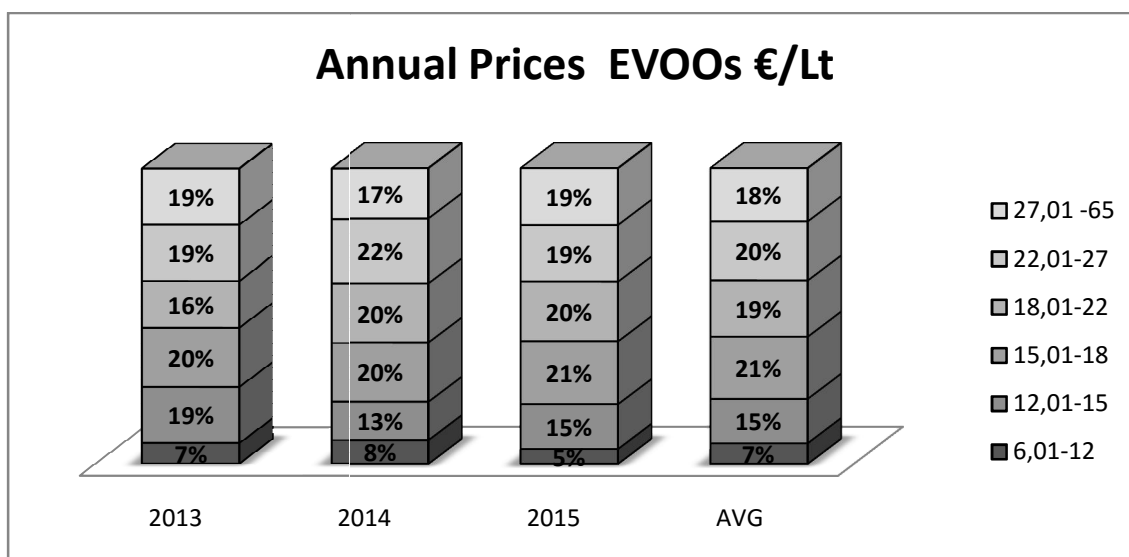


Figure 21. Annual prices of EVOOs: €/ Liter. Author's elaboration. Source: FLOS OLEI

At first sight this appears due to a choice of guide to orient themselves in the review of higher quality oils. However it is necessary to observe these prices per macro area and regional level, and then compare them with those at the national level. Overall, they show an upward trend of 2%, but it has to be highlighted that it was not possible to find any common patterns across the different regional prices. In fact, each one shows its own peculiar features and, consequently, its own specific market history.

From a first analysis of the price it emerges that the Northern has on average the highest prices: 37% more than the prices that it is possible to find in the Southern, and more than 20% of the average observed prices.

<i>Prices EVOOs €/liter per macro-area</i>				
Macro area	2013	2014	2015	AVG 3 years
North	31,34	29,92	29,78	30,37
Center	23,31	23,46	24,2	23,68
South	18,24	19,86	18,96	19,04
Tot Italy	22,71	23,1	23,19	23,01

Figure 22: Prices of EVOO: €/Liter per macro-area. Author's elaboration. Source: FLOS OLEI

Looking at the prices at the regional level the difference is clearer among the Italian macro-areas, as well as the trend among the three years. Comparing the data with those offered by ISMEA (ISMEA,2016) (Italian Institute of Statistics, agriculture and food sector), in terms of share of the given national average price, the olive oils with a higher price are those of the Northern-Central areas (with Umbria and Tuscany). However, the data available relates only to some reference markets (above all in the Southern), so it is not possible to make a detailed regional comparison.

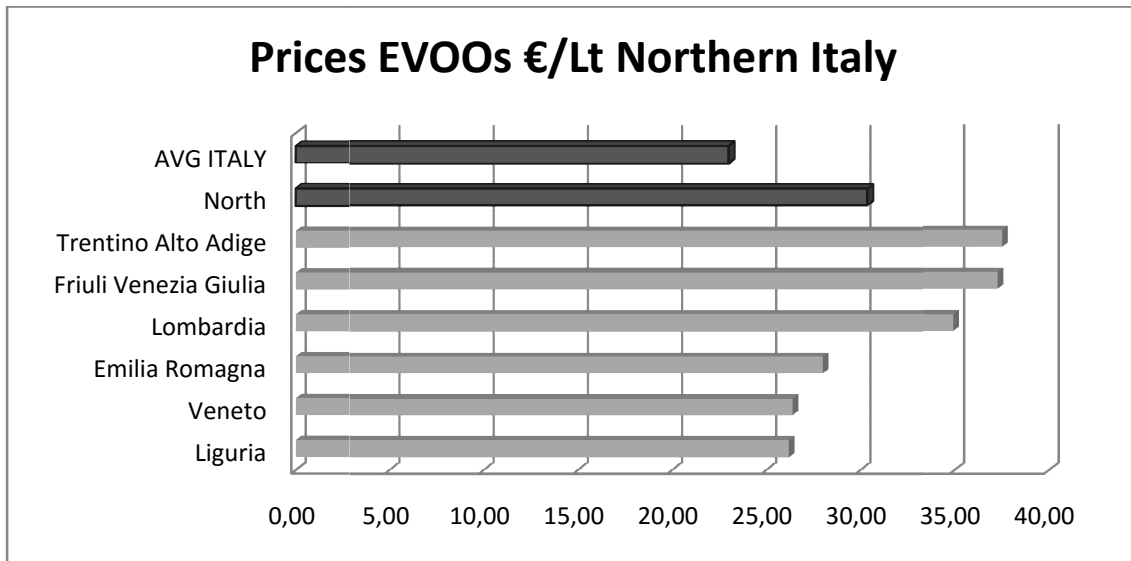


Figure 23. Average Prices of EVOOs: €/ Lt for Northern Italy. Author's elaboration. Source: FLOS OLEI

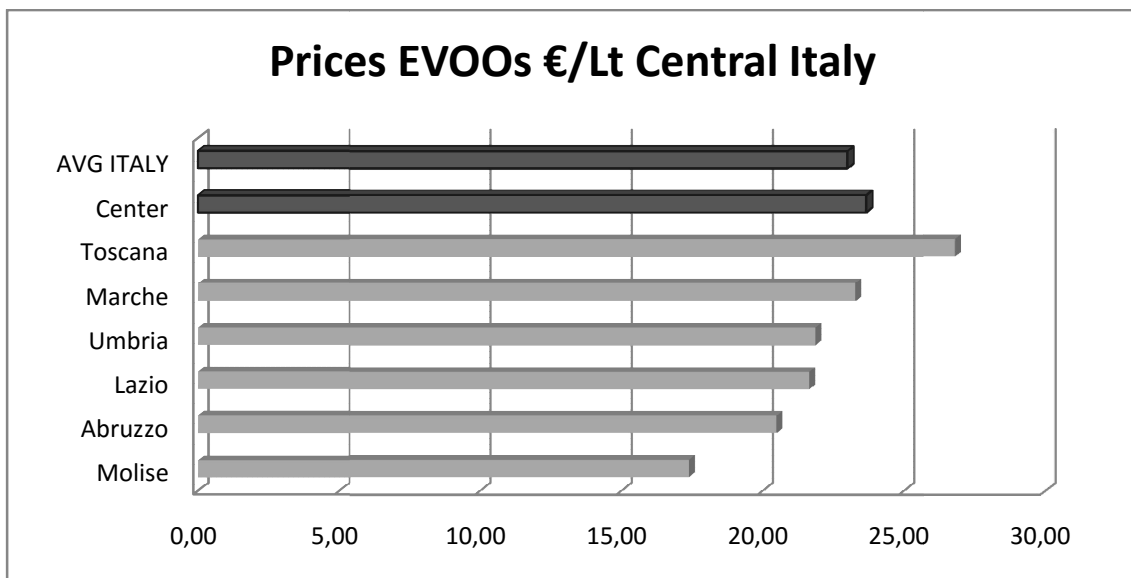


Figure 24. Average Prices of EVOOs: €/ Lt Central Italy. Author's elaboration. Source: FLOS OLEI

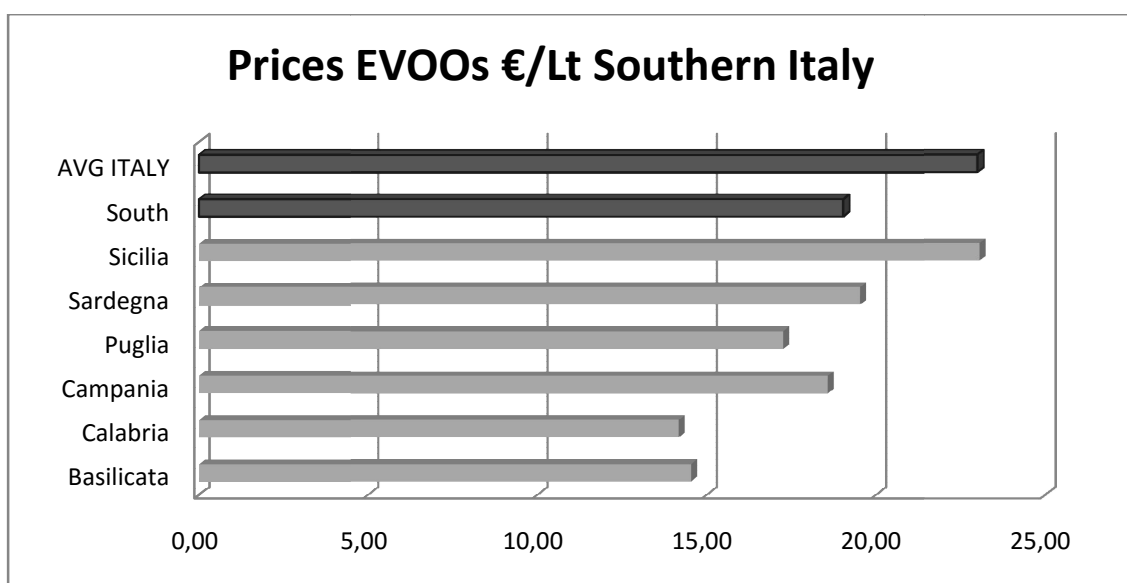


Figure 25. Average Prices of EVOOs: €/ Lt Southern Italy. Author's elaboration. Source: FLOS OLEI

As already mentioned, the highest prices of the EVOOs are concentrated in the Northern area. However, the analysis among the three years shows that the prices over the considered macro area are not the same. In detail, both Trentino Alto Adige and Friuli Venezia Giulia are leading the ranking of the prices with an average price of about 37€/Lt, followed by Lombardi, while in regions such as Emilia Romagna, Veneto and Liguria the prices are below the average of about 8, 13 and 14 percentage points of differences.

On average the prices in the Central part of the Italian territory are different compared to the previous one. While for the Northern an average price of about 30€/Lt is shown, in the Central area an average price of about 24€/Lt is observed. Looking in detail, Tuscany leads the ranking with prices above the average of about 13%. All the other considered regions are below the average. In detail Marche shows the highest prices (of about 23€/Lt), followed by regions such as Umbria, Lazio and Abruzzi which are on average about 20€/Lt. Molise has the lowest prices, with a distance from the average prices of about 26 percentage points.

In the Southern, it is possible to notice on average the lowest prices. Regions such as Sicily and Sardinia have the higher prices of about 21% and 3% respectively above the mean observed prices. Campania and Puglia show prices lower than the average of about 2% and

9% correspondingly and the lowest prices among all the considered samples are present in Basilicata and Calabria with an average price among the three considered years of about 14€/Lt, half of those observed in the Northern.

Paying attention to the olive oils that receive a mention for excellent quality-price ratio, it is observed that these represent only 18% of the sample, since in most cases the EVOOs analyzed have prices greater than 16€.

Considering that price has a strong territorial component, with the lowest prices concentrated in Southern and Central Italy, it is not surprising that this prize, in the majority of cases, is assigned to EVOO coming from these macro areas, especially in regions such as Puglia, Campania, Calabria (for the South) and Lazio (for the Center).

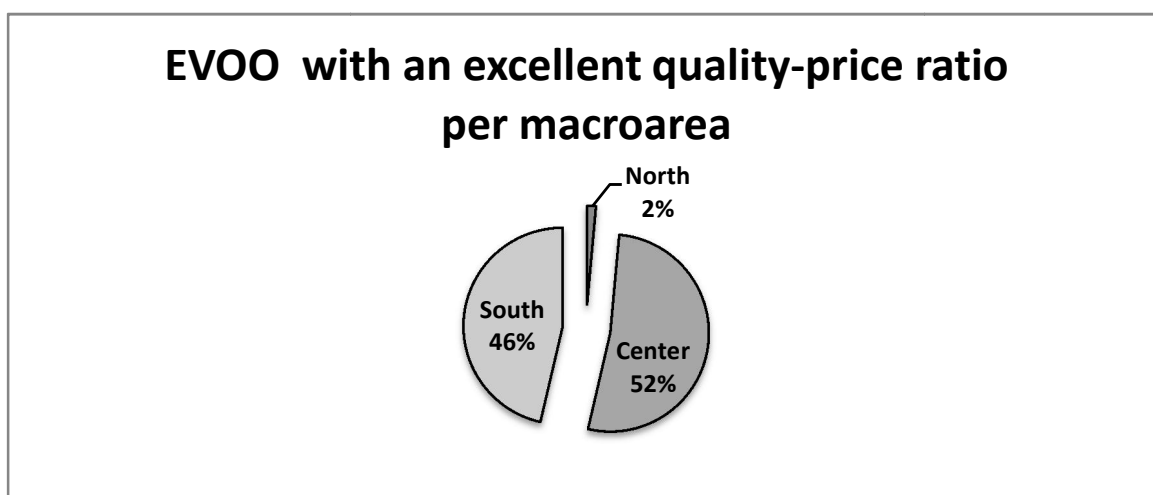


Figure 26:EVOO with an excellent quality price ratio per macro area. Author's elaboration. Source: FLOS OLEI

3.5.2 Attributes related to the product

Among this group, the quality variables that are selected as able to influence the market prices are: tasting category, bottle size and variety of olives, in terms of varieties used and lists on a national and local level.

3.5.2.1 Tasting category

In this study, the effect of the tasting category on EVOO prices is investigated. It is expected that some sensory characteristics are particularly appreciated by Italian consumers; thus, whether and to what extent they are associated with high price levels will be investigated.

Due to the large number of sensory characteristics that can be used by the experts to describe each EVOO, the information related to the tasting category was selected. The tasting categories are specified in three different levels: light, medium and intense fruity. For each of these, a dummy variable was created.

The majority of the reviewed EVOOs are in the medium tasting category (75% of the cases), followed by intense (16%); a residual percentage of EVOOs is characterized by a light taste (9%). During the three mentioned years, the composition among these categories has changed in favor of the intense category. While in the first considered year this category was representing 13% of the cases, in the third year it gained 6% points, at the expense of light and medium categories that lost the same extent of 3 percentage points.

In terms of prices, the EVOOs with an intense taste have the highest prices. In comparison with the light category, the difference is about 8% compared to the medium of 5%.

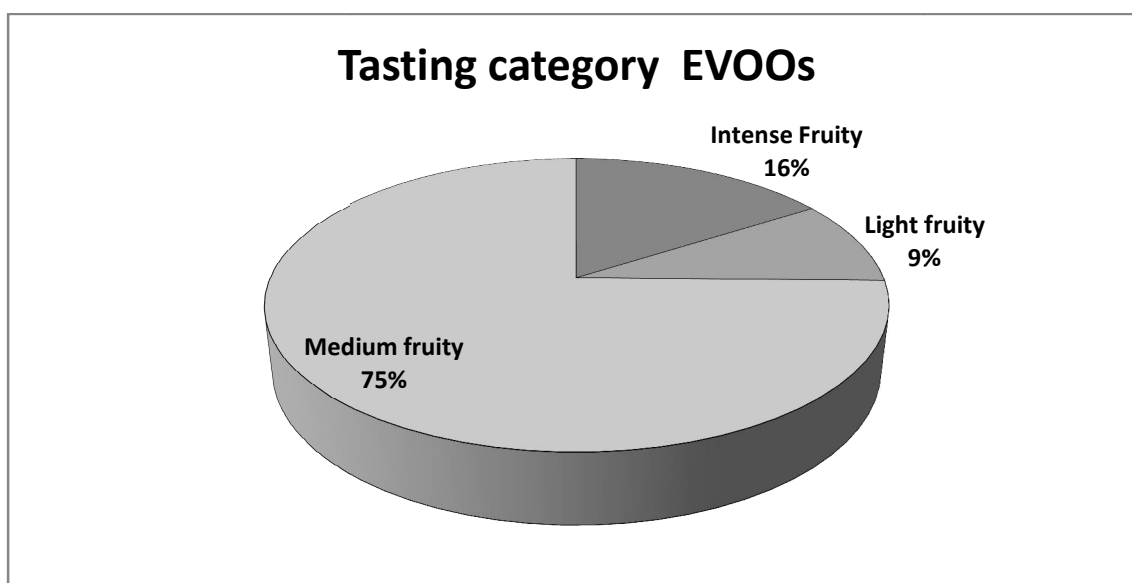


Figure 27: Tasting category for the analyzed EVOOs. Author's elaboration. Source: FLOS OLEI

Considering the tasting category for each macro area, it may be noticed that, in the majority of cases, EVOOs are concentrated in the medium fruity category, in the percentage of 64% for the Central area, 27% for the Southern, and 9% for the Northern. It is interesting to observe that intense flavour is the predominant characteristic of the olive oils present in the Central and the Southern areas (45 and 49% respectively), while for the North the intense category prevails for 53% with respect to the other macro-areas). In fact, the olive oil taste strongly depends on the environmental characteristics of the territory and

on the varieties of the olives used, as well as the soil composition. The consumers can recognize specific taste traits and associate them with the production area, as it is possible to observe in Fig. 28.

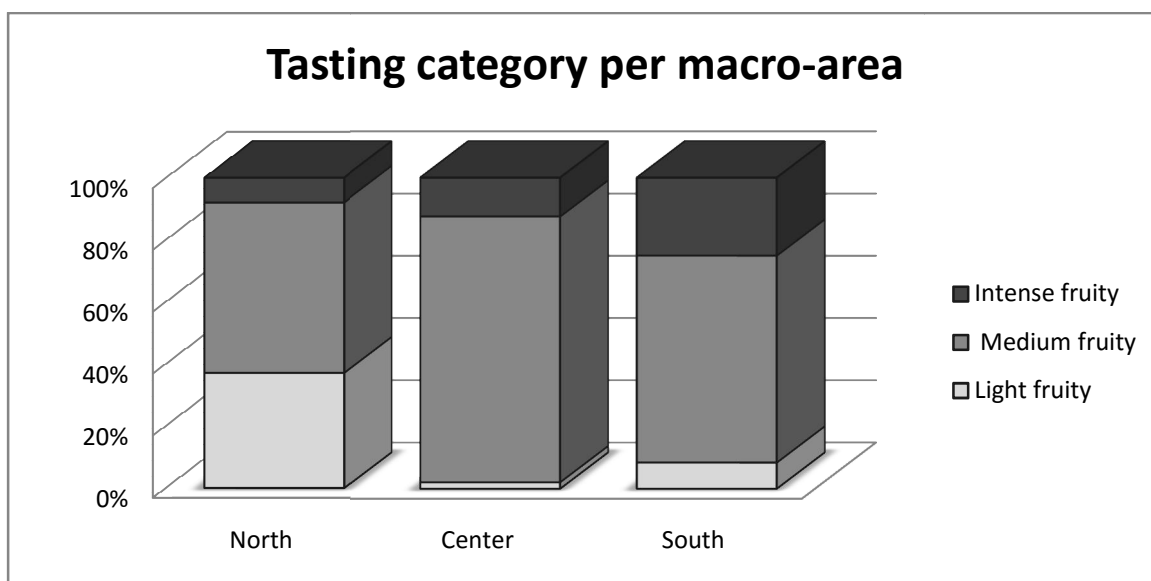


Figure 28: Tasting category per macro area. Author's elaboration. Source: FLOS OLEI

3.5.2.1 Varieties

Strongly linked to the concept of the tasting category is the olives variety used for the EVOO. In the dataset, the varieties are distinguished in terms of number (one variety or more) and in terms of diffusion at the national and local level. In Italy the majority of the varieties present in Europe can be found (500 cultivars). This is related to the characteristic of the territory. The current varietal offers are derived from intense varietal selection activities undertaken in the past, following the adaptation of the plant varieties to different soil and climatic environments that characterize Italian olive-growing (Pannelli & Perri, 2001). All the tree varieties are characterized by a close link with their land of origin, since every variety needs a specific combination of weather and field for growing.

The varieties of olive trees included in this study are 85. In the sample almost half of the EVOOs are produced using only one variety (48%), followed by two-three varieties (34%) and 18% of these are produced with more than four varieties.

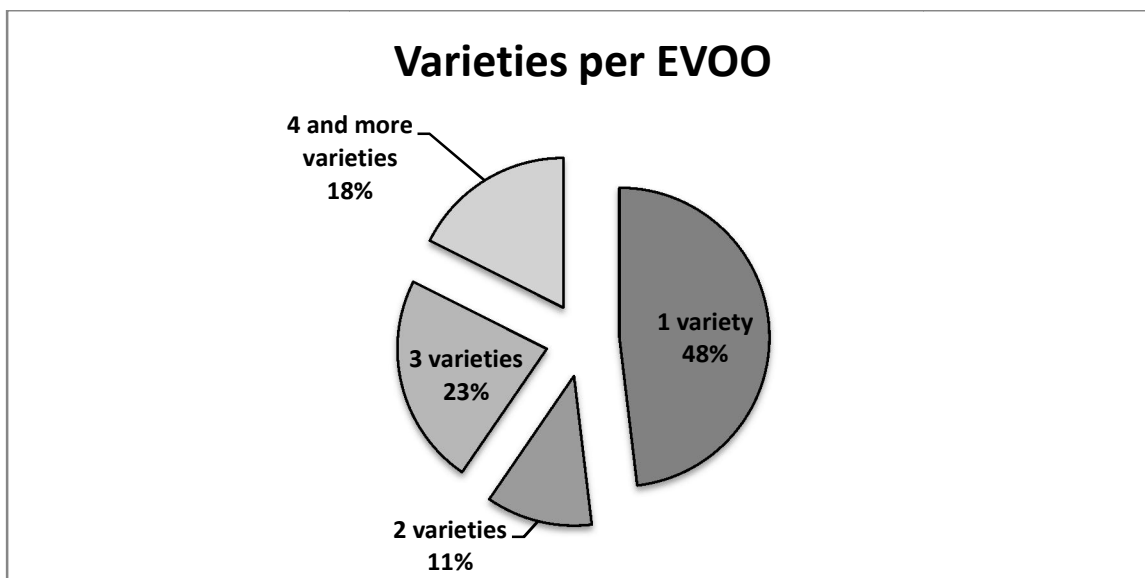


Figure 29: Number of varieties per EVOO. Author's elaboration. Source: FLOS OLEI

In Italy, only a very small percentage of the oil produced is *mono-cultivar* (one tree variety). Normally olive oil is produced with more varieties of olives processed together. In the study the results are different, because most probably in the last few years in Italy there has been a trend in mono-varietal oils, following a strategy of segmentation based on the promotion of the area of origin linked to the variety of olives used. In addition, this can be seen as a preference of the experts for the mono-varietal oils, in the high end segment of the market. It has to be underlined that there is no better olive oil in absolute, even in the mono-varietals ones, and the degree of appreciation depends often on the consumers' taste and preference.

The choice of producing a specific number of varieties is very important. A producer of olive oil has to consider that the production of olive oil is connected with the environment, so for every territory he has to choose the specific varieties for those conditions. In fact, different places, different from what is typical of the area of origin, may change the compositional characteristics of the olive oils, affecting the quality of the olive oil. At the regional level, Lazio, Campania, Puglia, and Sicily are distinguished for producing olive oil from one variety of olives, while in Tuscany it is usually the case of more than one.

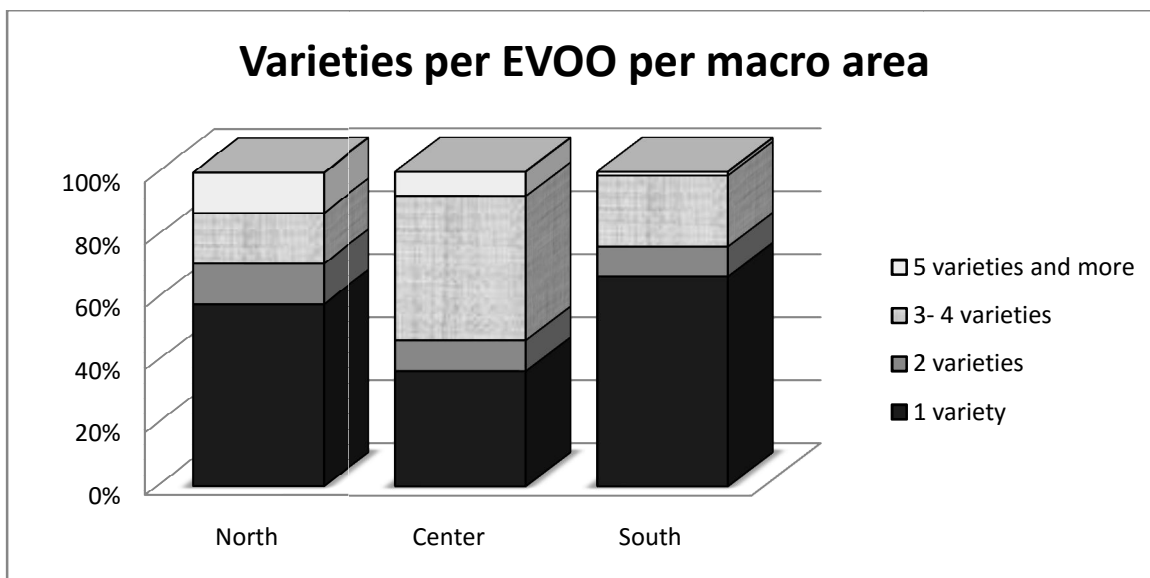


Figure 30: Number of varieties per EVOO per macro area. Author's elaboration. Source: FLOS OLEI

The mono-varietal olive oils present in this analysis are characterized by a medium and intense taste, as shown in Fig. 31. This can be seen as a possible tool of promotion for these kinds of olive oils based on the sensory attributes.

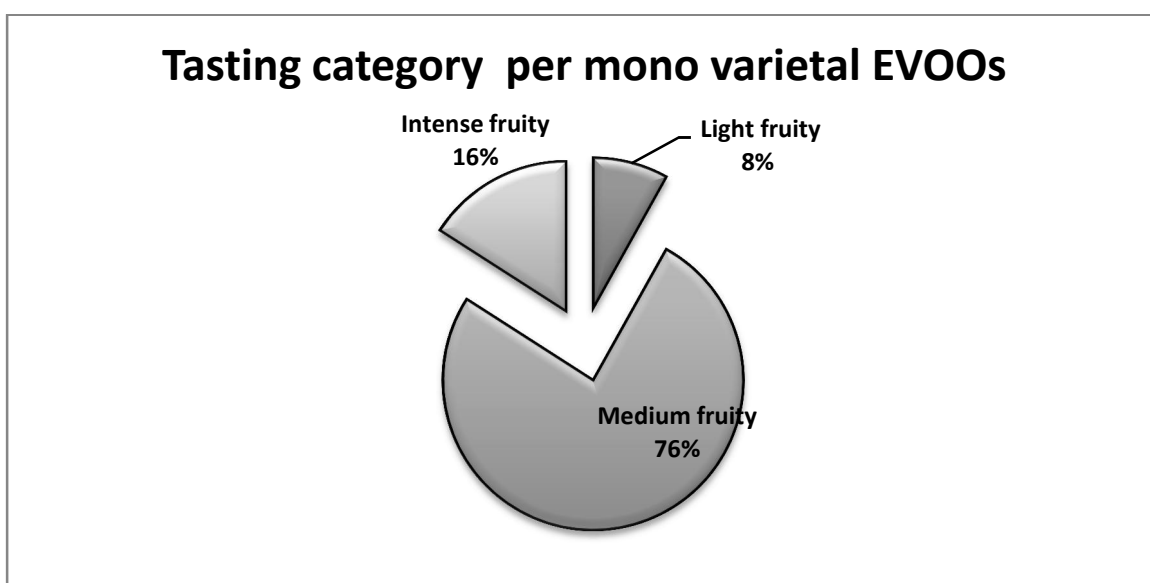


Figure 31: Tasting category per mono-varietal EVOOs Author's elaboration. Source: FLOS OLEI

The mono varietal EVOOs are produced, in most cases, with local varieties (76% of the EVOOs). Going through an analysis per macro area, in the Northern area, the production of mono-varietals with the use of local varieties is predominant, while the phenomenon is more mitigated in the Southern and in the Central areas (77% and 67% of the cases).

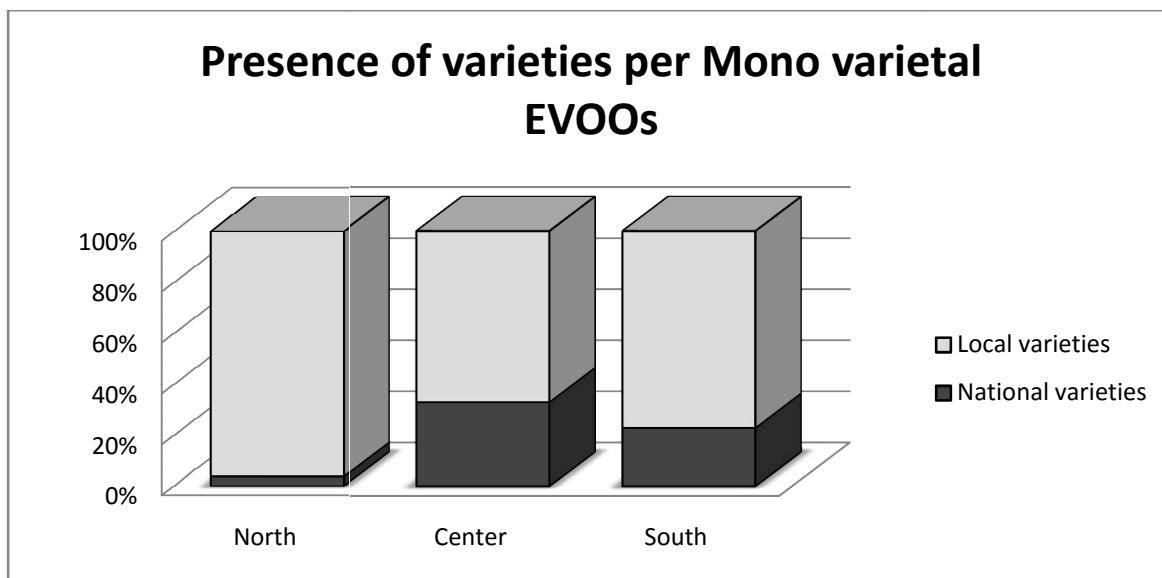


Figure 32: Geographical distribution of varieties per mono-varietal EVOO Author's elaboration. Source: FLOS OLEI

On the contrary, the EVOOs produced under the European Geographical Indication scheme, in most cases, are produced with the use of more than one plant variety (67% of the GI EVOOs).

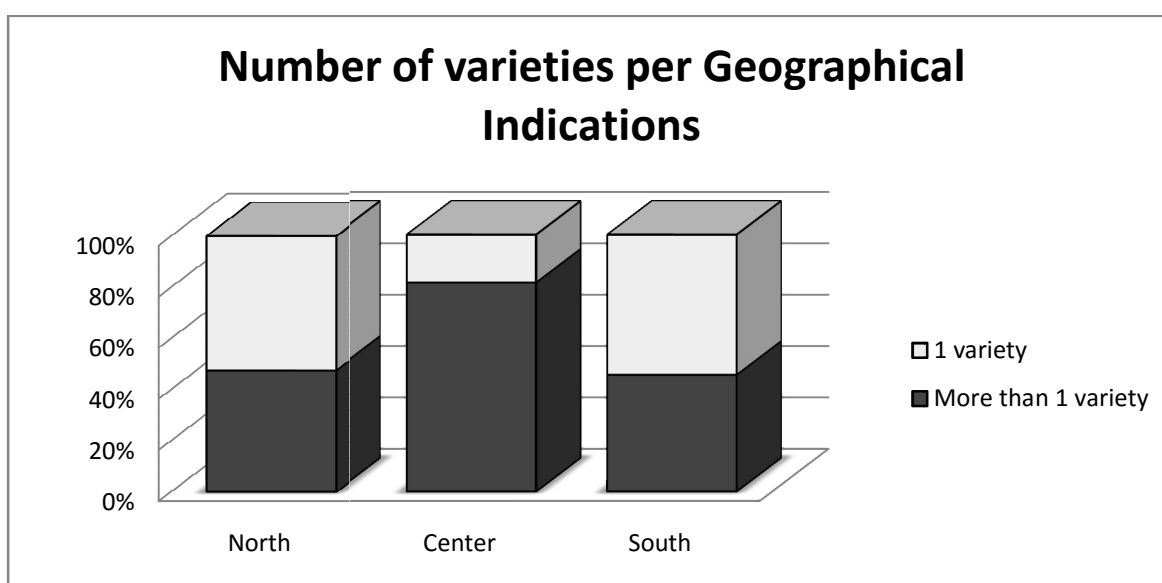


Figure 33: Number of varieties per Geographical Indication. Author's elaboration. Source: FLOS OLEI

This can be explained by the fact that for each denomination not only the area where the olive oil should be produced but also the varieties that can be used is established, as well as at which percentage, and in most cases, they are more than one. In fact, looking at Fig. 33, the olive oils coming from the Center are using more than one variety at a percentage of

81%, where olive oil such as Canino, Tuscia and Sabina PDOs (for Lazio) and Toscano PGI can be produced with different varieties. This is related to the scope of the GIs: to maintain and protect the tradition coming from the past, so the mono-varietal olive oils represent a recent trend, only for a specific segment of the market, in this specific case the high-end market.

The most common varieties present in Italy are: *Coratina*, *Frantoio*, *Leccino*, *Moraiolo*, *Pendolino*. In the study, a dummy variable was built to study the possible effect of these national variety on the final price. For the varieties present throughout Italy a link can be noticed between territory and the varieties chosen.

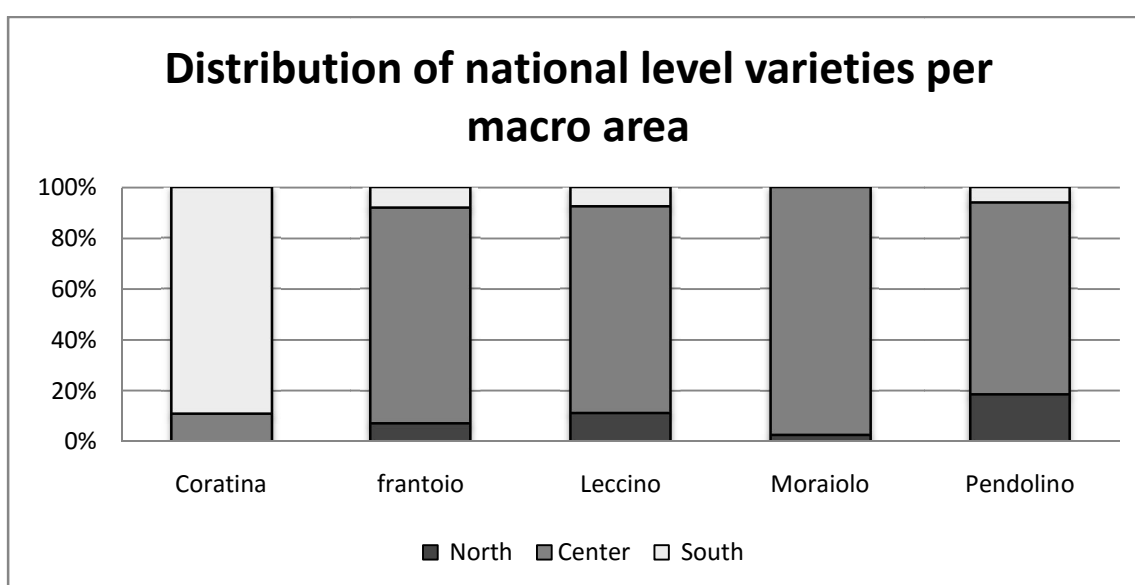


Figure 34: Presence of national-level varieties per macro area. Author's elaboration. Source: FLOS OLEI

These varieties are cultivated in all regions in Italy, taking into consideration the adaptability of the plants and the level of production. These kinds of varieties are more feasible in the case of intensive production. However each kind of variety is appreciated for its own characteristics. *Frantoio* and *Moraiolo* guarantee a high quality of oil (Cimato, 2014), while *Leccino* is more resistant to low temperatures. In the selection of varieties, the resistance of plants to various diseases that can affect the yield must be taken into consideration. For example, *Frantoio* is resistant to *Verticillium dahlia* and *Leccino* to *Spilocaeaoleagina* and *Bacterium savastanoi*.

These varieties give a medium taste oil and are the most produced and nationally known, as clearly defined in Fig. 35.

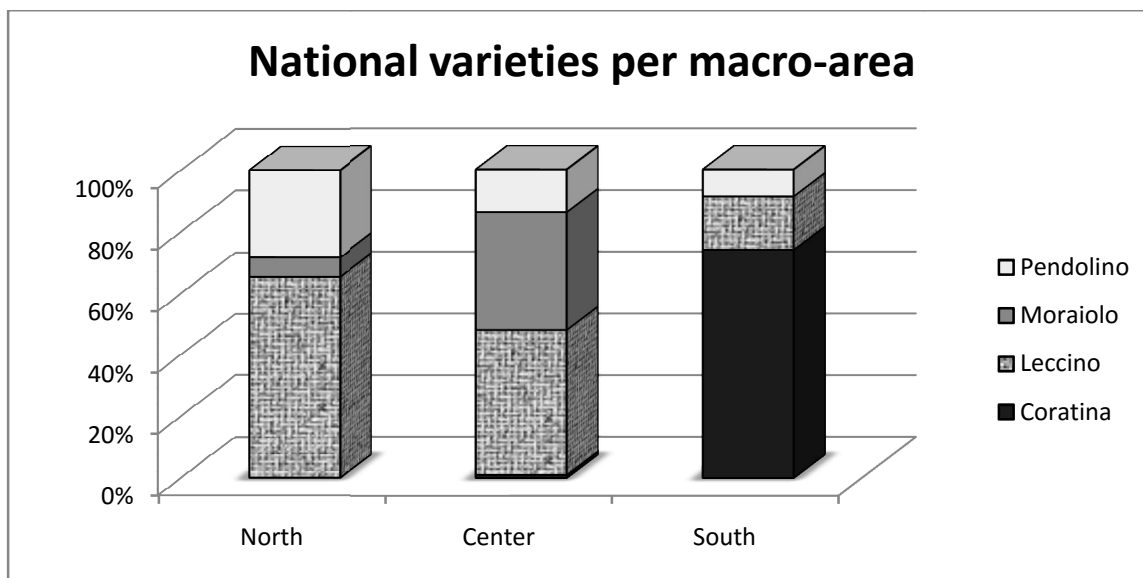


Figure 35. Distribution of national-level varieties per macro-area. Author's elaboration. Source: FLOS OLEI

Observing the national varieties per macro-area it is possible to notice that most of the analyzed farms in the sample in the North are producing EVOOs using the *Leccino* variety (45% of the cases), followed by *Frantoio* (31%) and *Pendolino* (19%), while the *Moraiolo* variety has a residual percentage of 5% and *Coratina* variety is not present.

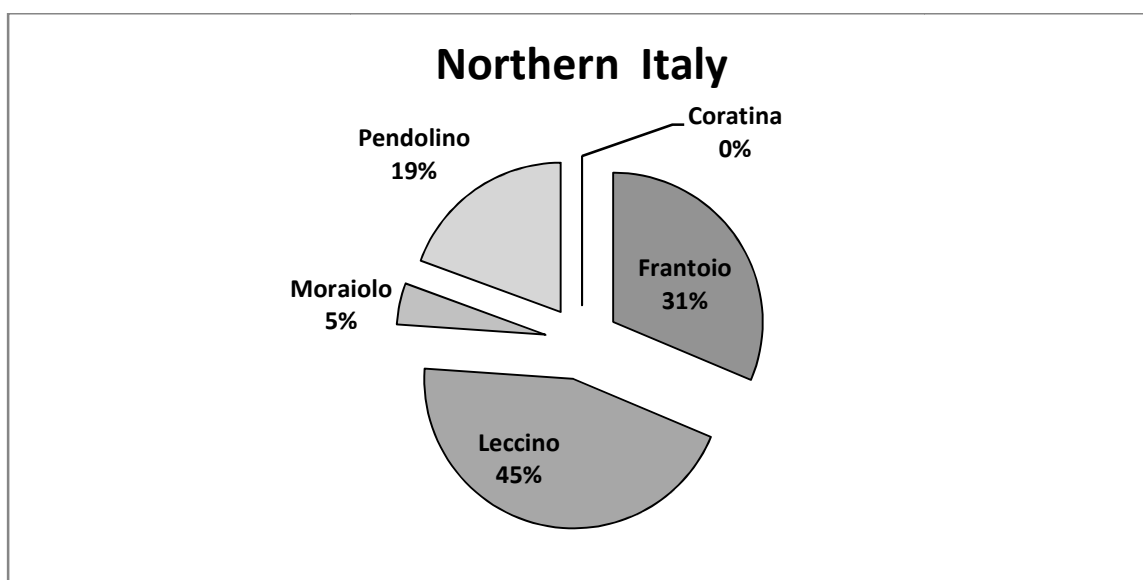


Figure 36. Distribution of national-level varieties in Northern Italy. Author's elaboration. Source: FLOS OLEI

In the Central area, compared to the North, more or less the same percentages for the *Frantoio* variety (34%) are observed, while *Leccino* (31%) and *Pendolino* (9%) are less

widespread. Differently from the Northern area, the *Moraiolo* variety counts for 25% and *Coratina* for 1%).

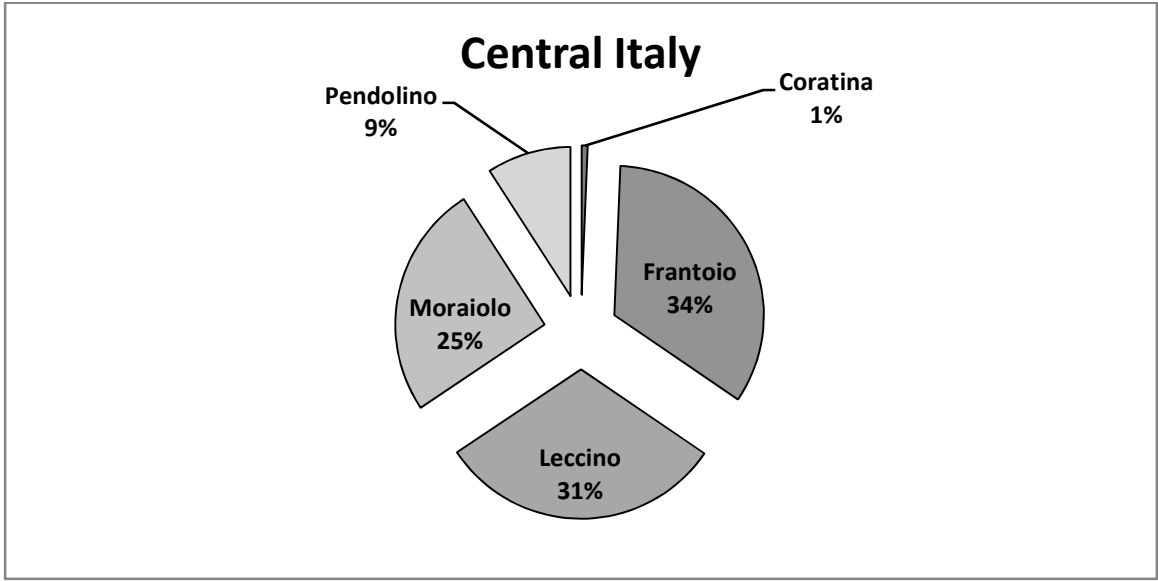


Figure 37 Distribution of national-level varieties in Central Italy. Author’s elaboration. Source: FLOS OLEI

In the Southern area the most common variety is *Coratina* (58%), while *Frantoio* (21%), *Leccino* (14%) and *Pendolino* (7%) are present in smaller percentages, and *Moraiolo* is not present at all.

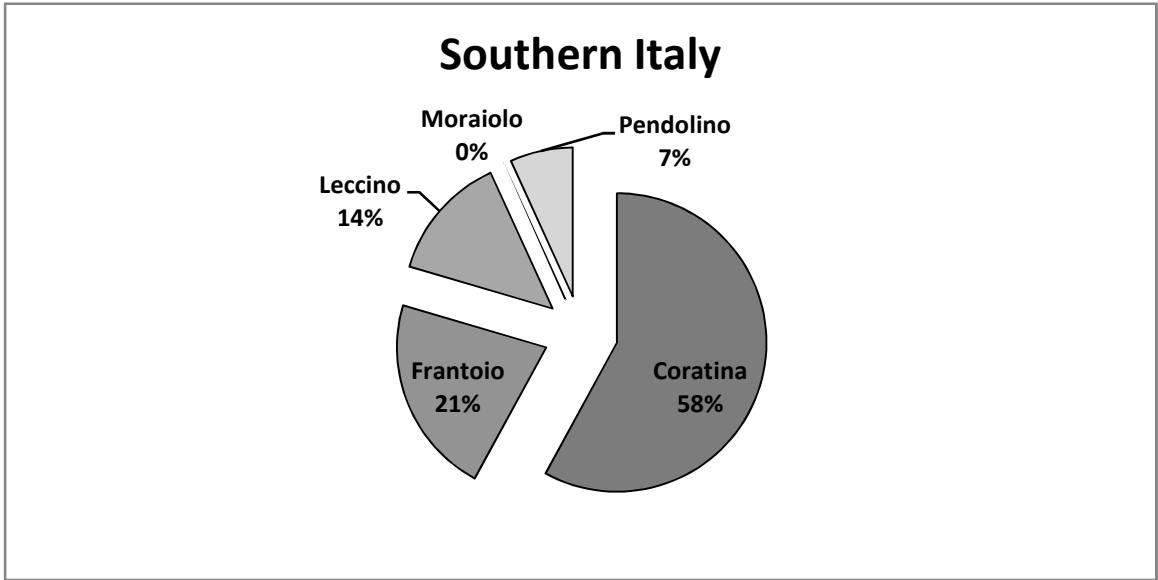


Figure 38 Distribution of national-level varieties in Southern Italy. Author’s elaboration. Source: FLOS OLEI

3.5.2.2 Bottle size

Relative to the size of the bottle, almost all of the EVOOs present in this dataset (90%) have been bottled in a 500 ml bottle. 6% of the sample has a size of 250 ml and the remaining 4% a size of 750 ml. The bottle size can represent an important driver of the choice of consumers. None of the analyzed EVOOs is sold in a 1 litre bottle size, due to the choice of aiming for excellence.

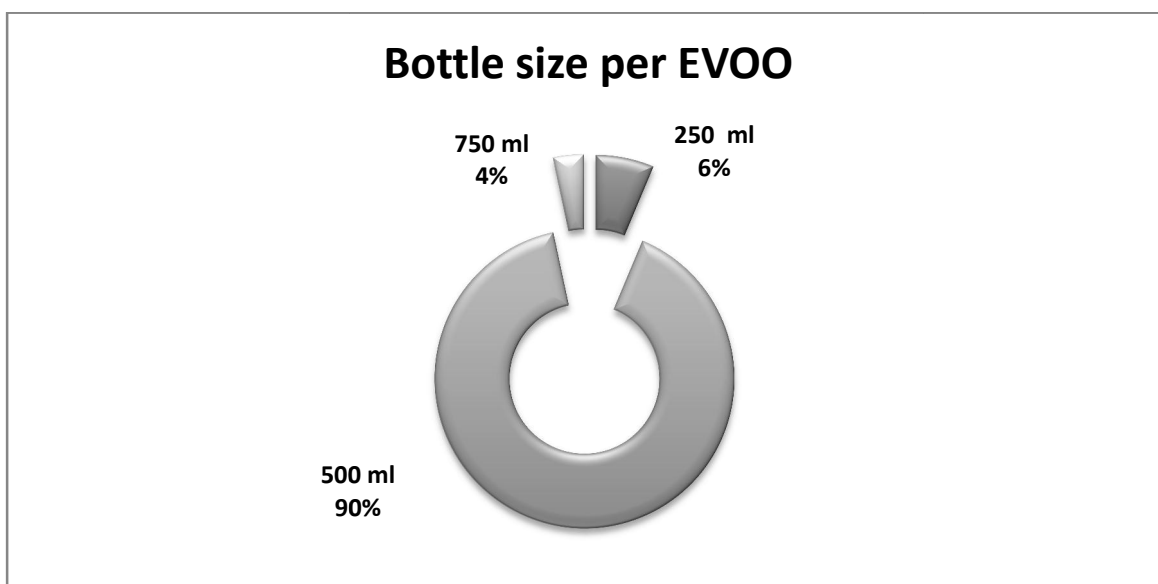


Figure 39: Bottle size per EVOO. Author's elaboration. Source: FLOS OLEI.

3.5.3 Attributes related to the farm and production process

This group of variables has been divided into attributes related to the farm, including the awards received, and the production methods.

3.5.3.1 Cooperative

In the study, the type of farm (cooperative or private farm) is considered. In the sample, referring to the three years, only a small percentage of the EVOOs are coming from a cooperative of farmers. In fact, the existence of farms in the dataset in the form of cooperatives is poor (only 8% of the sample).

Presence of cooperatives per macro-area

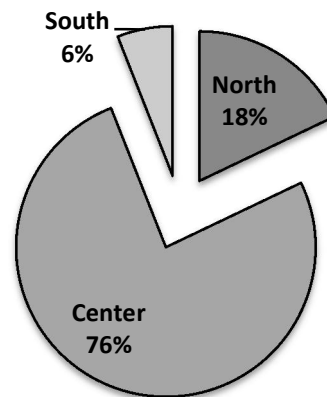


Figure 40: Presence of cooperative in the dataset. Author's elaboration. Source: FLOS OLEI

The cooperatives in the sample are more widespread in the Northern-Central area of the Country. Comparing the number of cooperatives with the total number of farms in the same macro area, it is observed that in the Northern-Central part about 12% of the farms are cooperatives, while the percentage drops to 1% in the Southern one. The sample differs from the Italian situation. In terms of number of cooperatives, excluding the social cooperative, as reported by the Italian Institute of Statistics (ISTAT, 2016), the major concentration of cooperatives is observed in the Central-Southern area of the Country.

In this dataset, the data seem to suggest a different behavior. Most of the cooperatives analyzed are selling EVOO at the high-end range. In fact on average cooperatives sell with a price of 24,00€/Liter. The regression will help us to understand if the premium price refers to cooperatives or to the macro area, since the majority of the cooperatives come from the Northern of the country (25€/L), where the prices are higher compared to the sample (in the Southern the average observed price for cooperatives is about 15€/L)

3.5.3.2 Farm olive oil production (Hectolitres)

In order to include in the analysis the dimension of the farms, the variable related to the annual production of olive oil of each farm was included. In this way it is possible to have an idea about the size of the farms, excluding all such data as the hectares and the trees owned, that are significantly affected by the place of origin. The annual production of the

olive oil variable was built starting with the creation of five different categories, considering the distribution of the sample, as indicated in Fig. 41.

With regard to the annual olive oil production, the average production expressed in hectoliters for the three reference years is about 195 hectoliters. However, it has to be considered that 37% of farms do not reach 34 hectoliters per year, and 31% of them produce in the range between 35 to 134 hectoliters. The remaining farms are producing in 14% of the cases from 135 to 335 hectoliters/year, while 18% produce in larger quantities (more than 336 hectoliters). It is useful to know that in the Italian pattern, there is a tradition of family-run olive farms. This kind of farm produces low quantities of olive oil and, therefore, the family consumes most of the produced olive oil.

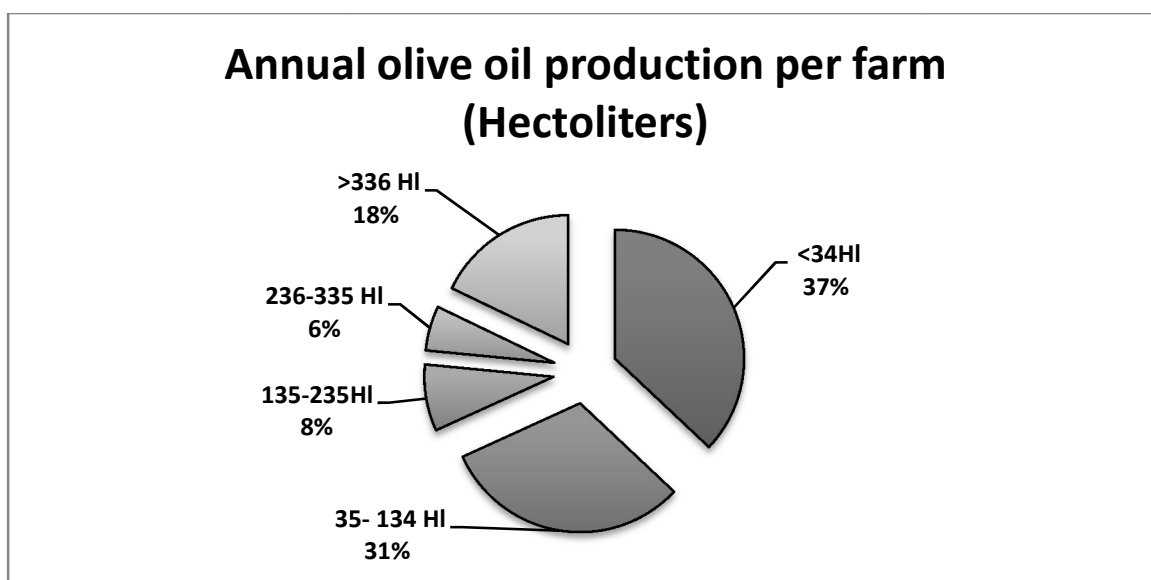


Figure 41: Production of olive oil in hectoliters per farm. Author's elaboration. Source: FLOS OLEI

These values reflect the farm size. 24% of the farms analyzed have a production greater than 235 hectoliters. This is mainly due to the size and volume of the processed olives. In qualitative terms, the production of small amounts can be perceived by end users as a sign of exclusivity, but on the other hand, greater production may enable the farm to penetrate the market and establish a reputation over time. In fact, olive oil is subject to seasonality production due to the biological cycle of the plants (the biological cycle is almost two years). This means that farms can buy olives to process in order to face the demand of the market and increase their reputation.

Looking at the presence of a farm mill per annual olive oil production, it is evident that a big percentage of the farms that produce an amount of olive oil higher than 236 hectoliters own a farm mill (85%).

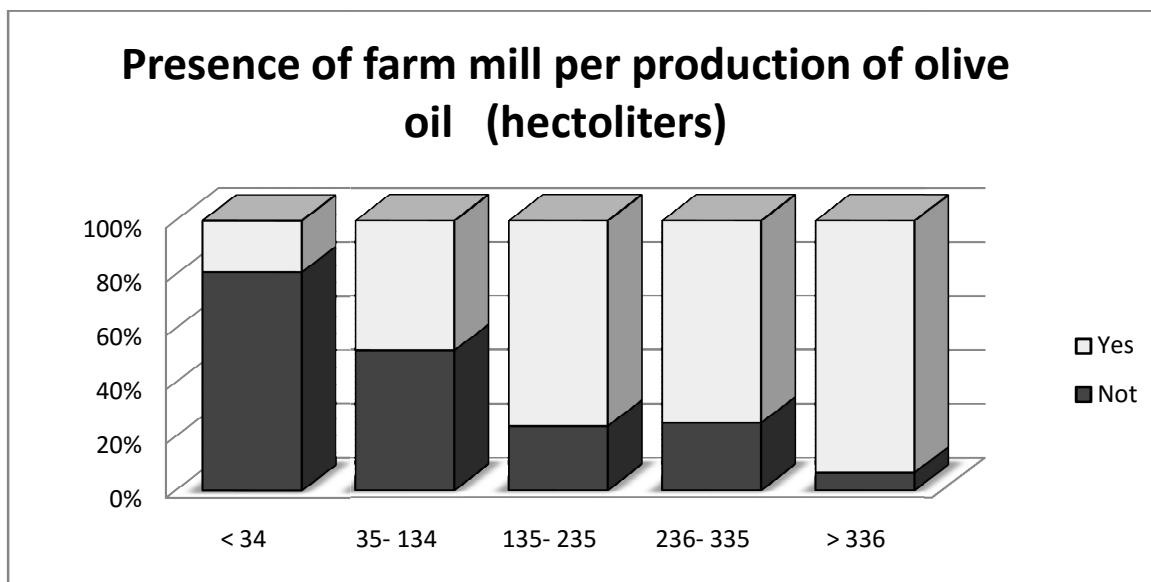


Figure 42: Presence of farm mill per production of oil in hectoliters. Author's elaboration. Source: FLOS OLEI

3.5.3.3 Olives produced and purchased

In the considered sample, as also observed in the Italian farming of olive oil (INEA, 2015), the most productive farms are located in the Southern of the Country. In fact, in this area 34% of the farms have a yield per hectare higher than 53 quintals of olives. The observed percentage for the same categories of quintals produced is 14% for the Central and 9% for the Northern part. The productivity of the farm, at the macro-area level, is influenced by environmental characteristics such as climate, composition of the soil, rainfall, as well as the varieties of olives produced.

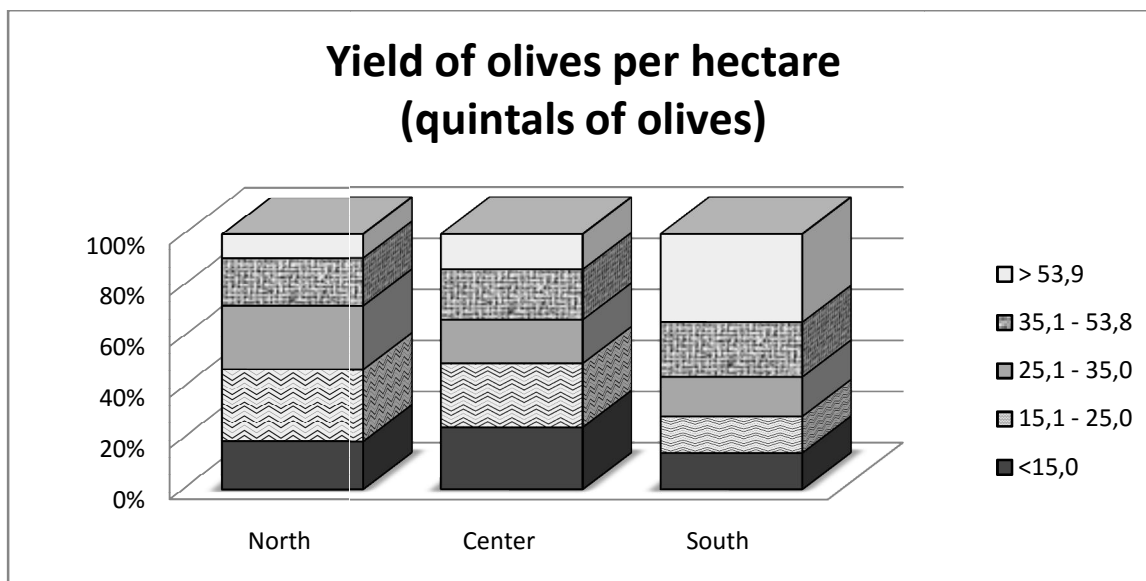


Figure 43: Yield of olives per hectare. Author's elaboration. Source: FLOS OLEI

Considering the annual production of olives, it is confirmed that farms with greater production tend to process the olives in a farm mill. 78% of farms with an enhanced production of 216 quintals of olives own an on-site mill.

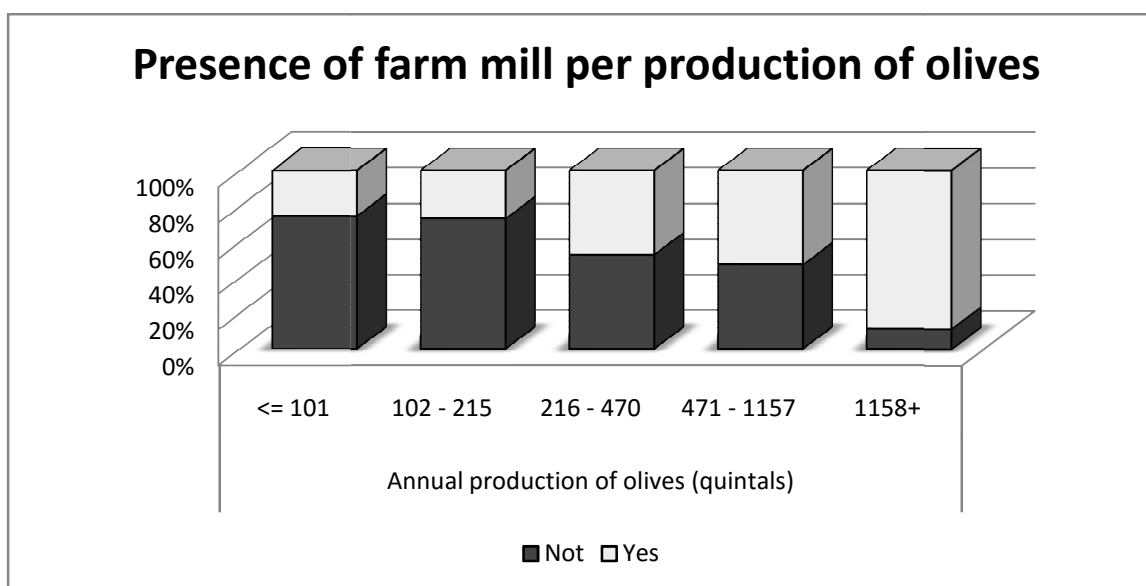


Figure 44: Presence of farm mill per production of olives (quintals). Author's elaboration. Source: FLOS OLEI

To better understand the data presented above it is necessary to build on another variable regarding the “yield of olives per tree”. The study of this variable helps to understand the territorial composition of the analyzed farms.

As shown in Fig. 45 below, the yield per tree is much higher in the Southern area. As already mentioned, this is mainly related to the climate characteristics of this part of the country. The extraordinary adaptability of the olive growing in conditions of poor rainfall make olive growing the only possible agricultural activity. In Southern Italy, the mild climate allows for greater growth of the plants and consequently a high productivity. 63% of the olive groves with a yield of more than 0.15 tons of olives are concentrated in the Southern part. The percentage drops to 32% for Central Italy, and 21.9% in the Northern.

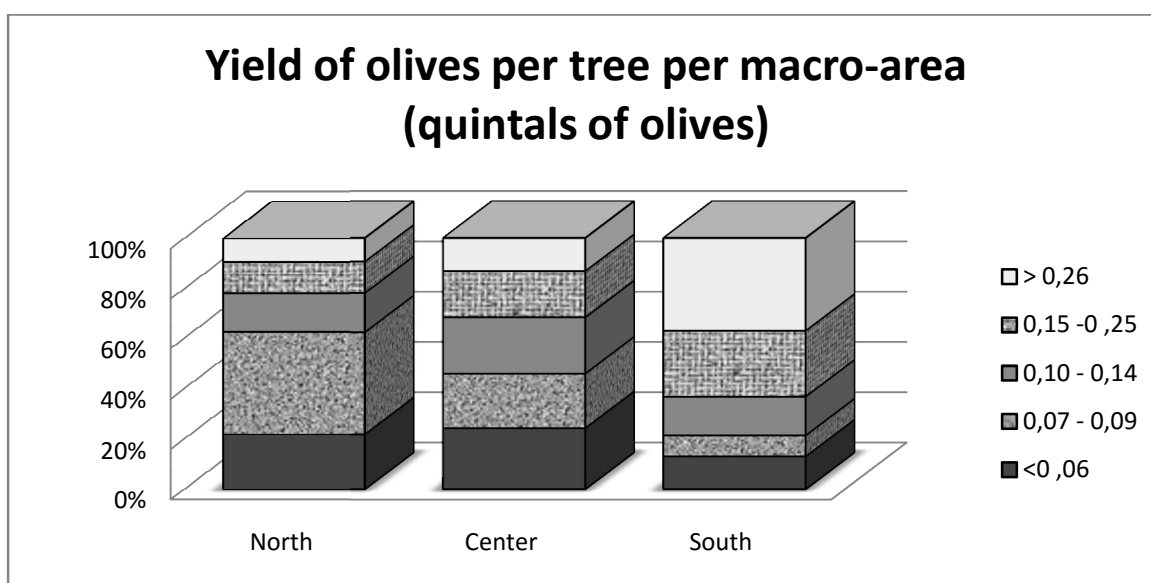


Figure 45: Yield of olives per tree per macro-area Author's elaboration. Source: FLOS OLEI

Observing the yield per tree referring to the organic production, as expected, the yield is less than the regular one. For the average yield per tree among the three considered years, it is observed that on average the organic production is 34% less than the conventional one. In detail, decomposing the data per macro-area, it is noticed that while in Northern and Central Italy the difference from conventional farming is respectively about 11 and 18%, for the Southern, the difference is stronger (about 37%).

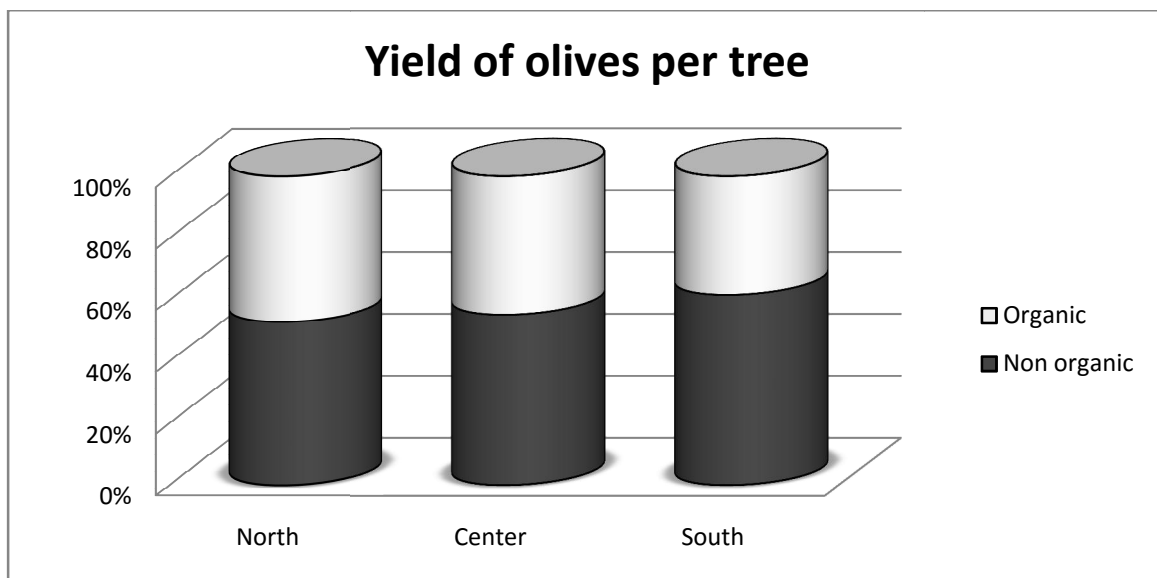


Figure 46: Yield of olives per tree. Author's elaboration. Source: FLOS OLEI

Not all the olives processed in the on-site mill are produced with the olive trees of the farm. In fact, 18% of the farms analyzed buy olives. In particular it occurs in the central and southern areas (respectively 39 and 37%).

For the purpose of the study, this variable was created as a dummy to consider if the purchased olives bought, in percentage, were greater than 50%.

Considering only the farms that buy olives in a percentage equal or superior to 50%, the total average number of farms that decide to buy olives from other farms drops to 10%.

Looking at the average size it is noticed that the bigger farms are also the farms that prefer to buy olives to process. The average size is about 42 hectares, with differences among the macro-areas. In fact, while in the Northern the mean is about 10 hectares, and in the Central it is 13 hectares, the increase in the Southern reaches an average of 93 hectares (more than the average of the mean size¹⁵).

¹⁵It should be remembered that in the Southern area, the size of the farms in general is bigger than the Northern and Central Italy.

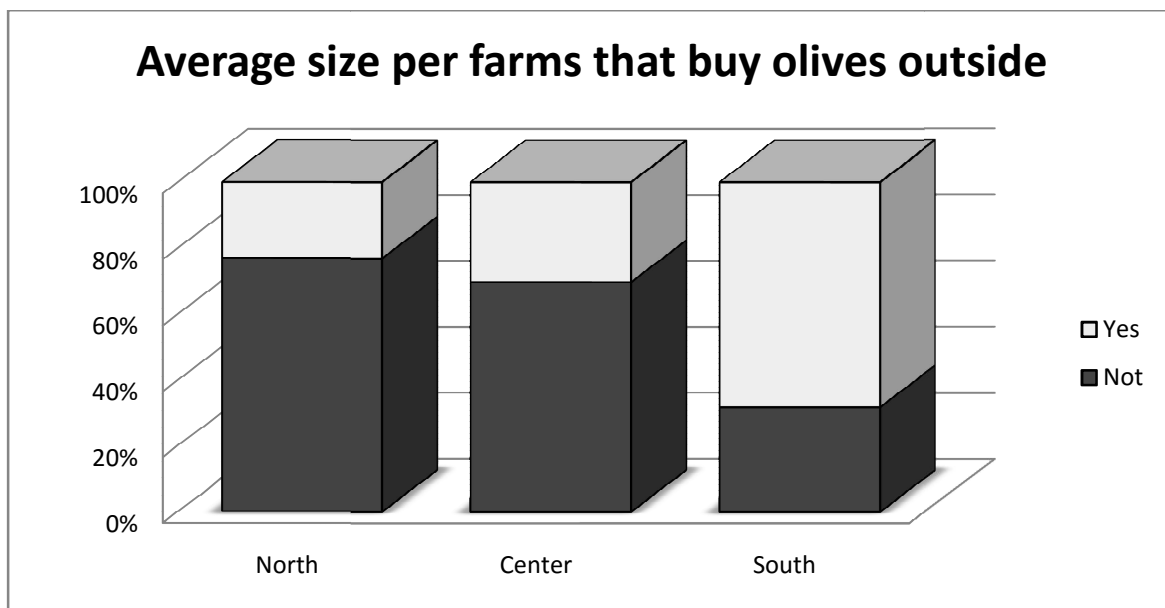


Figure 47: Average size per farm that buys olives for processing. Author's elaboration. Source: FLOS OLEI

However, observing the farms that buy in large quantities outside (more than 50%), the mean size drops to 16 Hectares (39% less than the average size). In this case 78% of the farms are coming from the Central-Southern areas, followed by the Northern (22%).

3.5.3.4 Harvesting method

The production of EVOO of good quality can be affected by several factors. This paragraph analyzes the production process that may affect the quality of the final product. These agronomic factors, among others, are able to affect the quality of the olive oil before it reaches the mills. Some factors are not controlled, such as the climate condition and diseases of the trees. However, some of them can be controlled by the farmers such as the time and method of harvesting.

A dummy variable was created, considering if the farm is harvesting using the traditional way of hand picking and beating, or if the mechanical method is used.

The farms analyzed mostly choose the traditional methods, hand picking and beating (53%), rather than the modern ones (19%), while mixed methods that combine hand picking and mechanical harvesting are chosen in 28% of the cases.

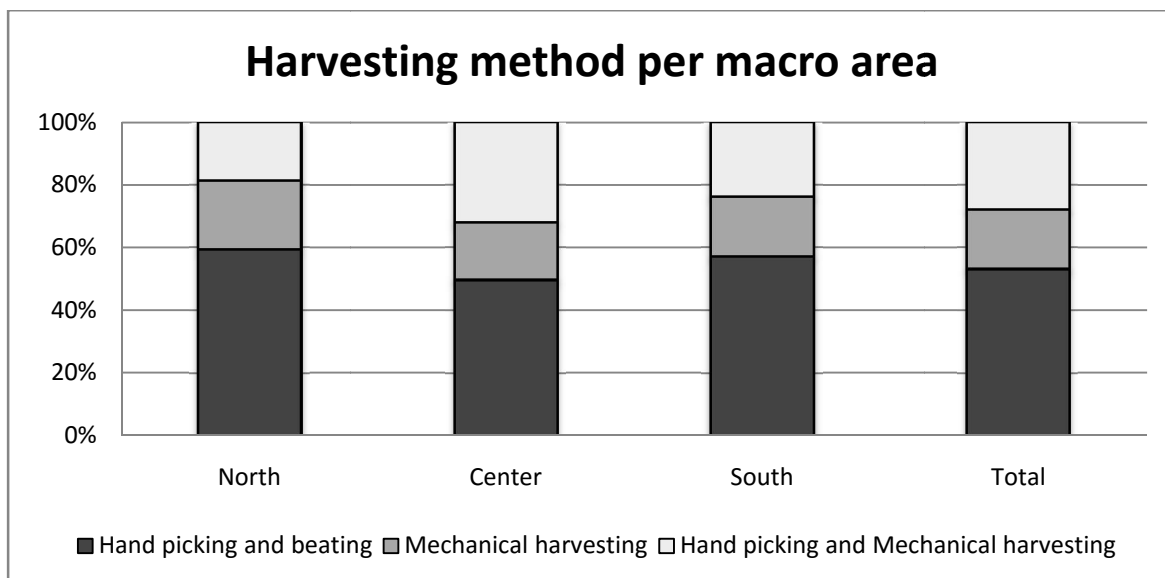


Figure 48: Harvesting method per macro area. Author's elaboration. Source: FLOS OLEI

The study of the sample shows that the farms considered prefer the traditional way to harvest the olive tree. The choice of the different kinds of harvesting methods is related to the farm size. As shown in Figure 49, the small farms, due to the costs, choose hand picking in the majority of cases, while the mechanical way of harvesting is preferred with the increasing of the size. In fact, if the size is more than 50 hectares, mechanical harvesting is chosen in 40% of the cases; when the size is more than 5 hectares, this percentage drops to 10%.

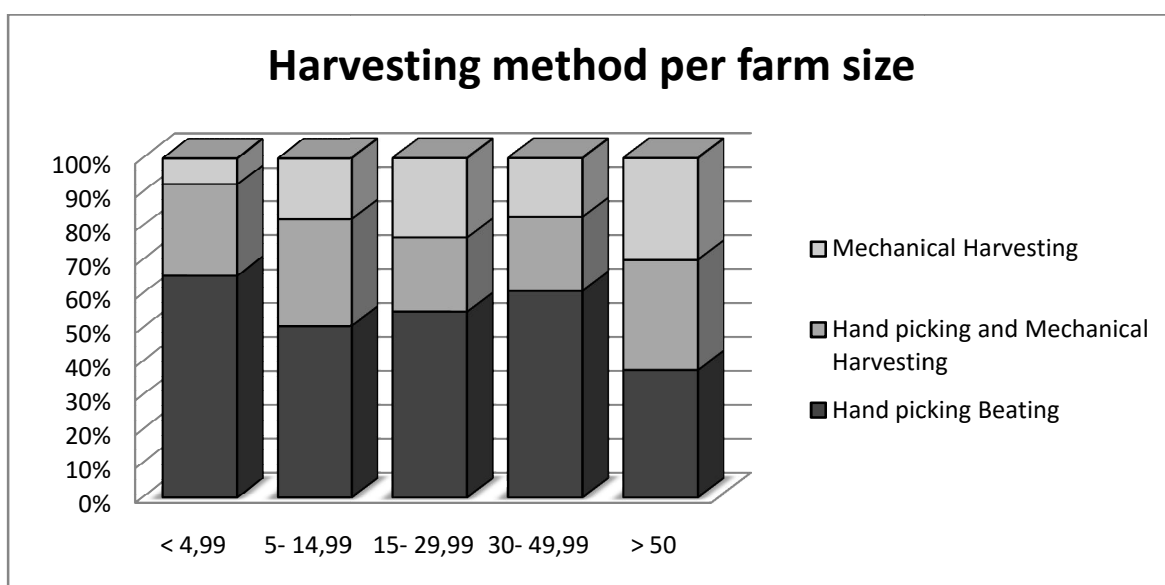


Figure 49: Harvesting method per farm size. Author's elaboration. Source: FLOS OLEI.

As expected, the bigger farms decide to use the mechanical technique of harvesting. The average size of the farms that are choosing this technique is about 39 Ha (against 35 Ha for the traditional ones). However, while in the Northern-Central areas the choice of harvesting depends on the hectares, in the Southern something different is observed. In fact, the farms that are choosing traditional harvesting have a mean size of about 62 Ha against 46Ha compared to the mechanical ones.

This can be explained by the fact that in this macro-area olive growing and its growth have been constrained by natural and structural conditions, such as a slow process of mechanization.

Having an onsite mill can influence the choice of the harvesting method. In the observed sample, 58% of the farms with a private mill are choosing the mechanical way of harvesting. This can have several reasons. First of all, the bigger farms have their own mill, so they can afford higher costs than the others. In addition, this technique can guarantee savings in terms of time. For olive oil, having a brief period between harvesting to milling is essential. Experts suggest that this process should be done in a day so as not to allow the olives to pick up humidity and therefore decrease the quality of the final product.

The choice of the harvesting method depends also on the varieties of olive trees. Some varieties are characterized by the small size of the olives, so for this reason, hand picking becomes the only solution for harvesting. In addition, beating susceptible varieties and in conditions of high humidity can contribute to the spread of the Mange (*Rogna*), a dangerous disease for the olive tree. It is worth mentioning that the yield of mechanical harvesting is influenced by the varieties of the olive trees. Varieties such as *Frantoio*, *Leccino* and *Coratina* (the most common in the sample and at the national level) respond well to the shakers. This is confirmed in this study. With reference to the most common varieties at the national level, it is observed that the farms that have these varieties tend to use more mechanical methods of harvesting, compared to the others. There is also another technique for collecting olives. Some farms prefer not to harvest, and wait for the natural drop of the olives, but in this case, the quality of the olive oil is not high, so for this reason in the sample, this technique is not considered.

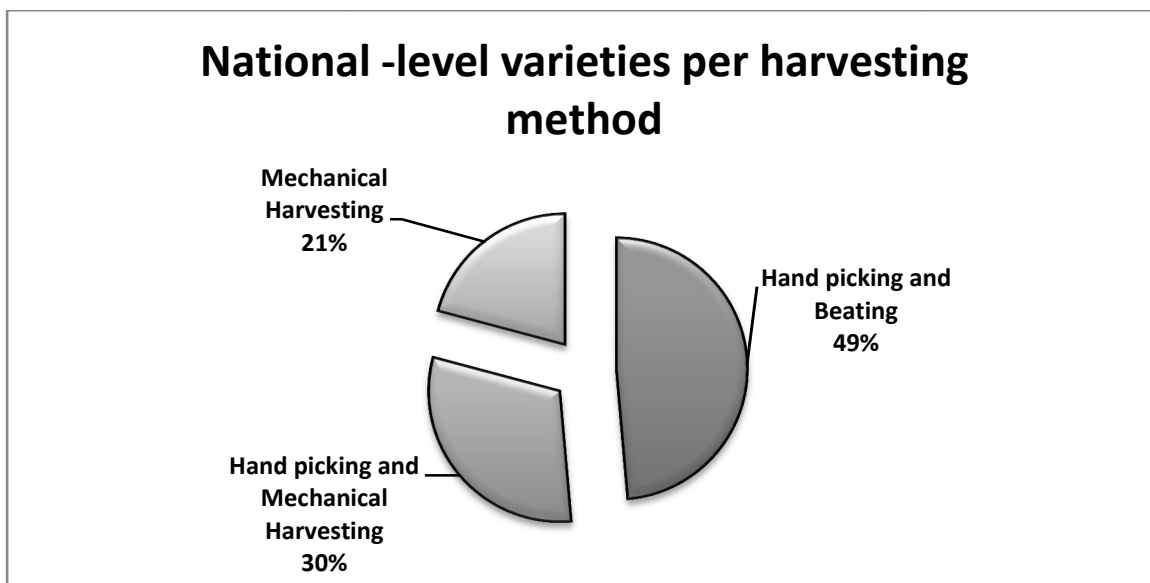


Figure 50:National varieties per harvesting method. Author’s elaboration. Source: FLOS OLEI.

3.5.3.5 Farm mill

In the analysis, the information about the presence of a farm mill is taken into account. This aspect can represent an important attribute, since the olive oil produced by a farm mill can be perceived of higher quality than an olive oil that is industrially produced. In the sample, about half the farms don’t have a mill. The comparison between farms with an onsite mill and the total number reviewed shows that in the Central and Southern areas there is the highest incidence of farm mills (respective 34% and 51%), while in the Northern one the percentage goes down to 15%. Observing the distribution of olive oil mills per farm size, it is observed that the choice of processing the olives in an onsite mill depends on the size of the analyzed farms. Usually the biggest farms have their own mills. In fact, 58% of the farms with a medium-large size have a farm mill. This can be explained by the costs of maintenance of the mill.

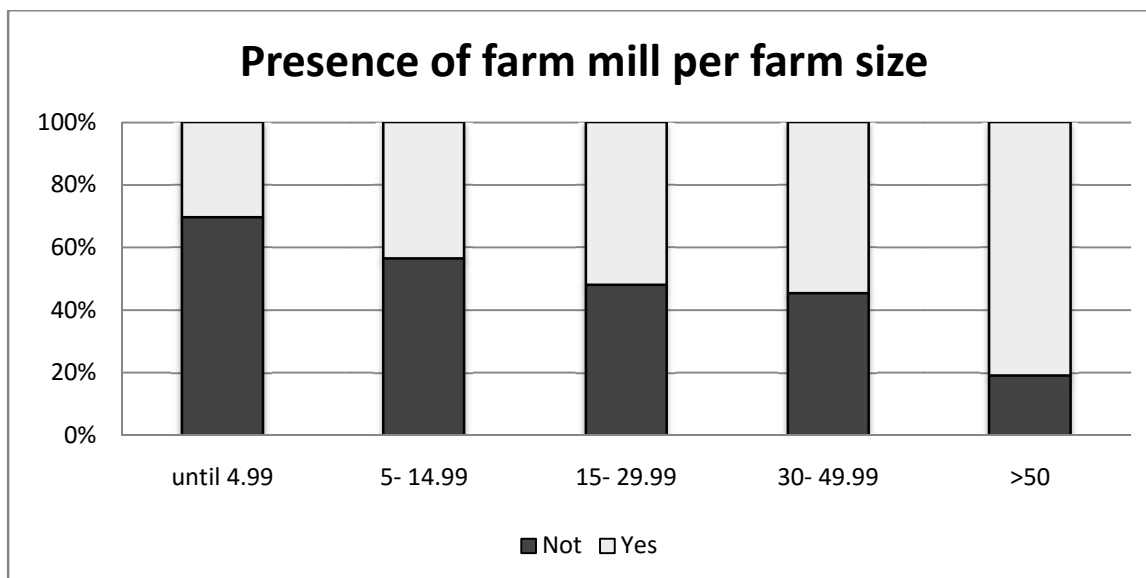


Figure 51: Presence of farm mill per farm size. Author’s elaboration. Source: FLOS OLEI.

To justify the costs of an onsite mill a minimum amount of production in terms of olives is necessary. Therefore, for the small farms it is more efficient to process the olives in an external mill.

Looking at the production in hectoliters what has already been mentioned is more evident. In fact, 85% of the farms that produce an amount of olive oil higher than 236 hectoliters own a farm mill.

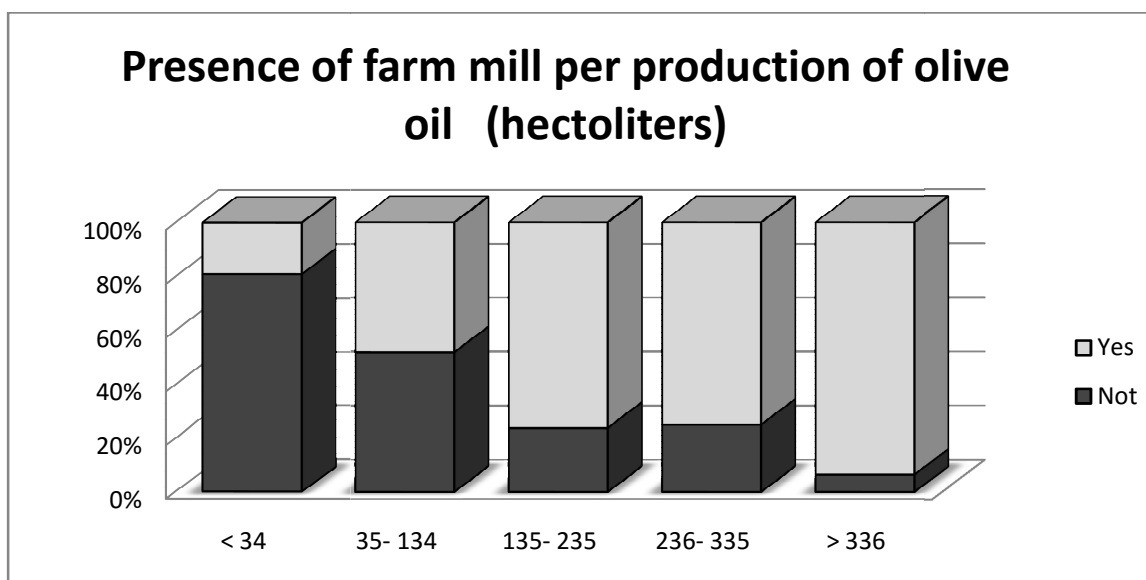


Figure 52: Presence of farm mill per production of oil in hectoliters. Author’s elaboration. Source: FLOS OLEI

Considering the annual production of olives, it is confirmed that farms with greater production tend to process the olives in a farm mill. 78% of farms with an enhanced production of 216 quintals of olives own an onsite mill.

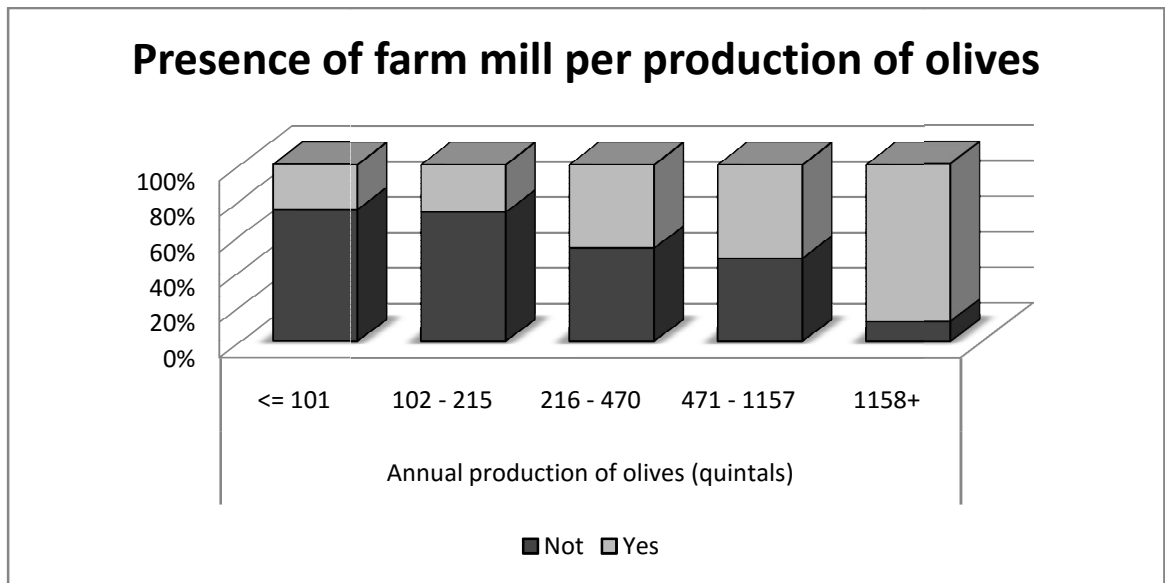


Figure 53: Presence of farm mill per production of olives (quintals). Author’s elaboration. Source: FLOS OLEI

The year of foundation and farm dimensions are related to the possession of a farm mill. The farms that were founded earlier and the larger ones tend to own a mill for the production of olive oil.

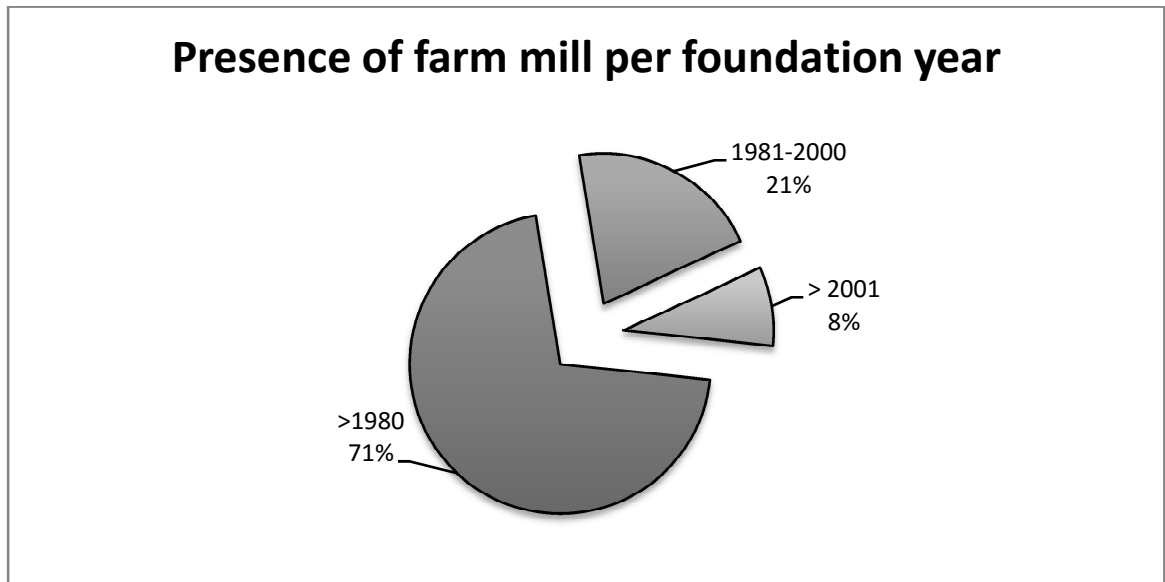


Figure 54: Presence of farm mill per foundation year. Author’s elaboration. Source: FLOS OLEI.

3.5.3.6 Organic production

With respect to organic farming, the organic EVOOs represent one third of the sample accounting for 31% of the reviewed ones. In the North this percentage drops to 7%, while in the Centre-South part of the Country, this figure increase respectively to 60% and 33%.

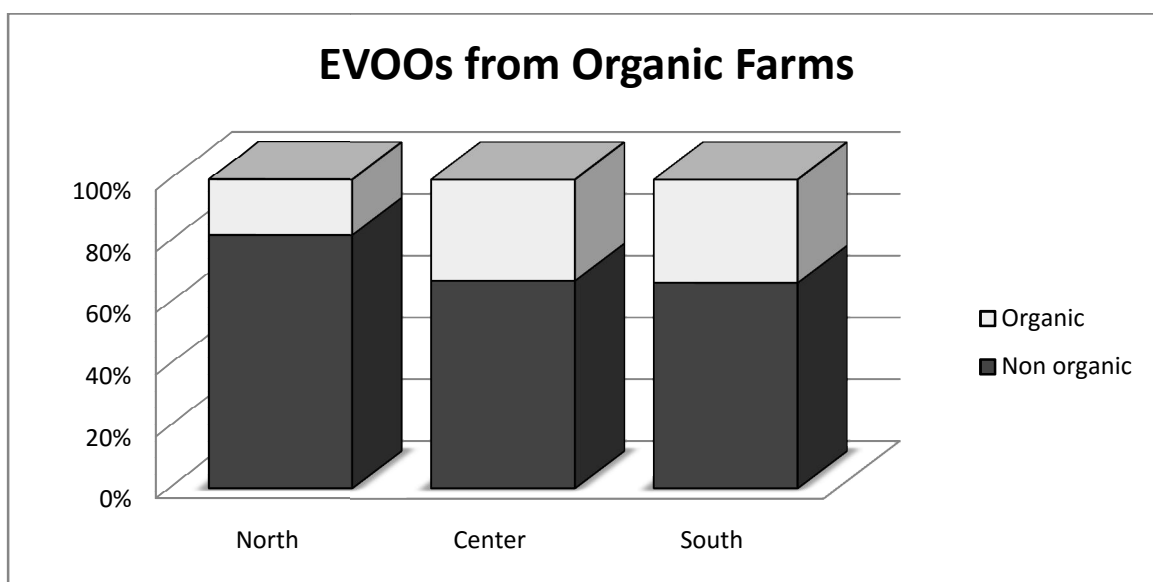


Figure 55: EVOOs from organic farms. Author's elaboration. Source: FLOS OLEI.

Decomposing this data at the regional level, the regions with the highest percentage of organic farms are for the Central part, Tuscany, Lazio and Umbria (51%), followed by Sicily, Campania and Puglia (24%) for the Southern.

The organic farms in the sample are not big in terms of size. 54% of the organic farms occupy an area of less than 15 hectares. This is related to the choice of analyzing farms that represent excellence in the Italian olive oil sector. It is worth mentioning at this point that compared to the traditional ones, the organic farms, on average, are producing lesser quantities of olive oil due to the fact that these kinds of farms are not using fertilizers. In addition, in this case the olive oil tree starts to bear fruit after 7-8 years.

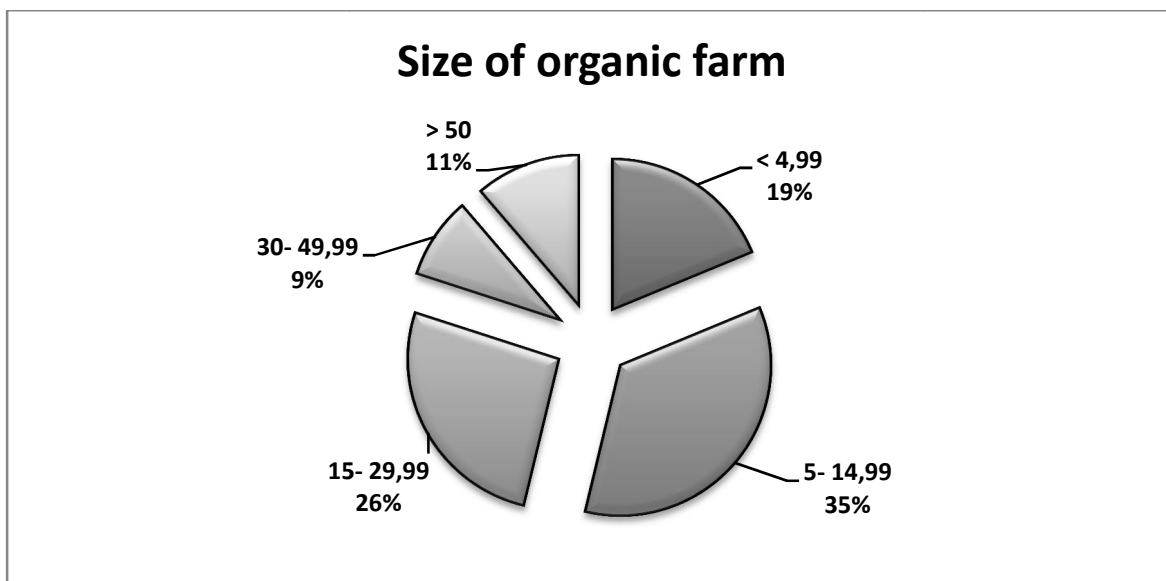


Figure 56:Size of organic farm. Author's elaboration. Source: FLOS OLEI.

Interestingly the organic farms present in the guide receive on average a higher ranking compared to the total farms reviewed. As shown in Figure 57, 46% of the organic farms received a high score (between 90 and 100), while in the observed sample this percentage is 44%. It is possible to conclude that the EVOO produced following the organic method has a positive reputation and a high sensory quality awarded by the experts.

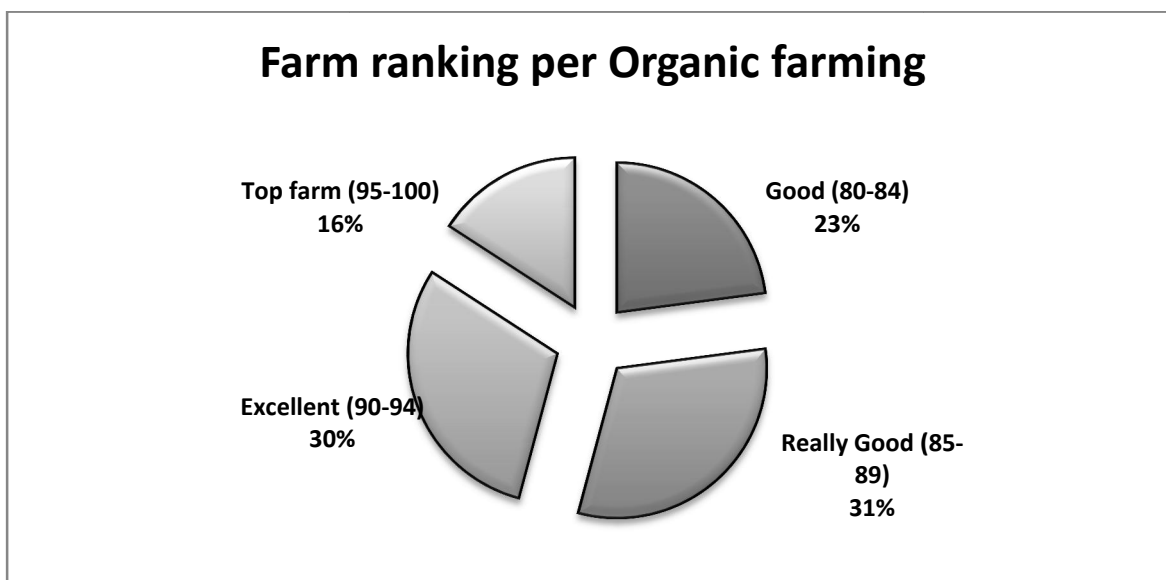


Figure 57:Farm ranking per organic farm. Author's elaboration. Source FLOS OLEI

The EVOOs produced by organic farms in most cases (83%) are in the medium taste category, followed by the intense fruity category with a percentage of 14%. A residual percentage of EVOO (3%) comes from the light taste category. This is most probably

related to the varieties used and the processing method. In fact, these farms have a specific regulation for each step of the production process. Observing the data per macro-area, it is seen that, while the composition, in terms of taste in the Northern macro- area shows differences, in the Central and Southern area, most are characterized by a medium-intense taste.

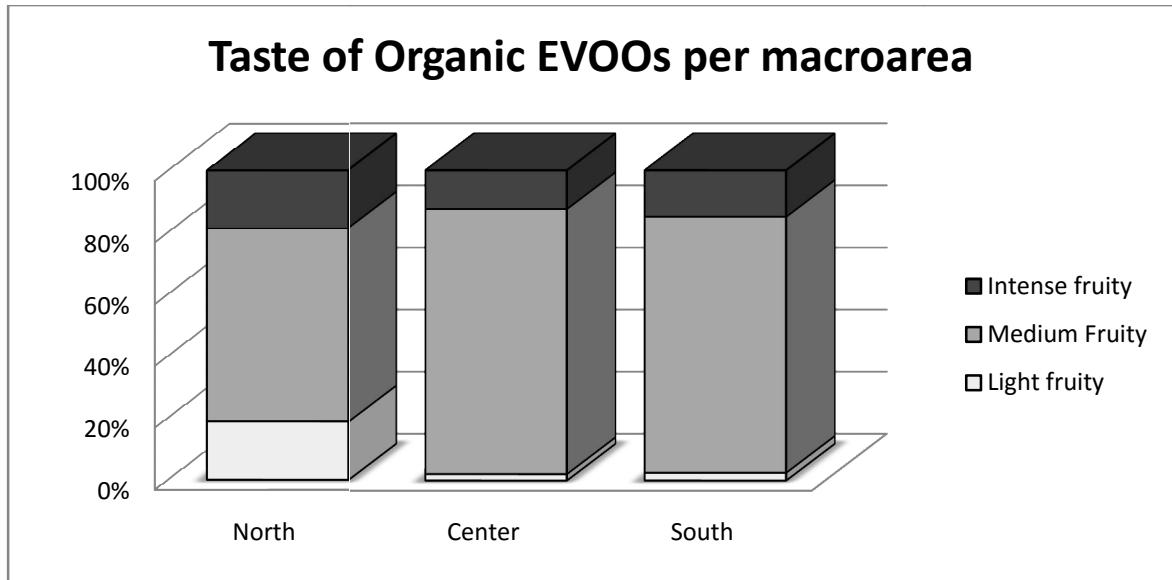


Figure 58: Tasting category per EVOO from organic farm

3.5.3.7 Farm ranking

As regards the rank assigned by the experts, the average score given is 89 (which corresponds to the “Very Good” category), for all three considered years. In terms of point scales, there are fewer cases of lower scores (22%), compared to the highest grades (44% of the farms received a score of more than 90 points), but none of the considered farms and EVOOs achieved the maximum score (99-100).

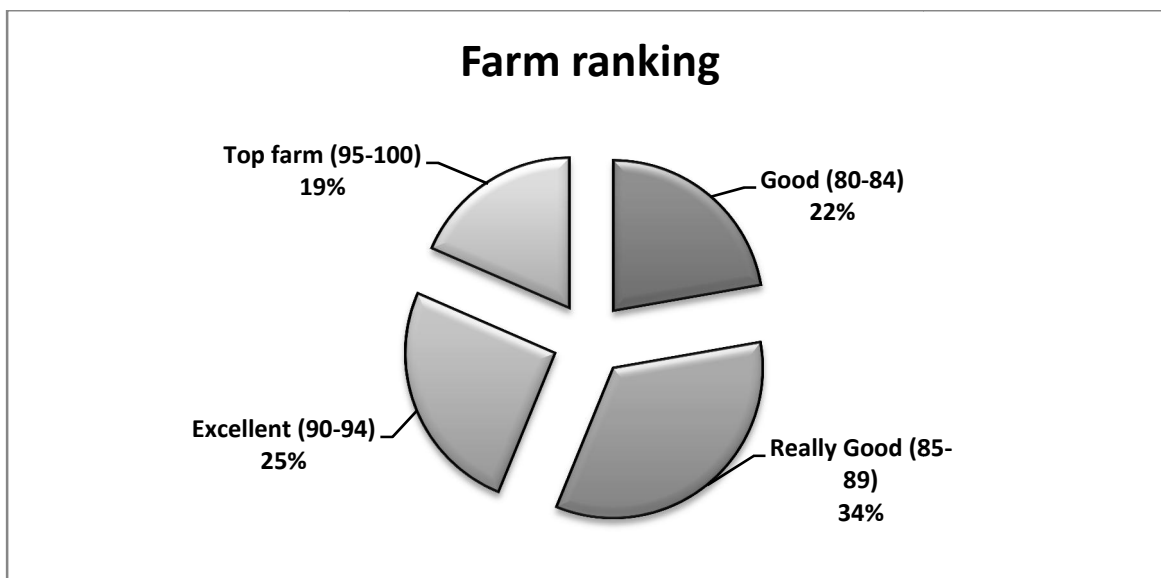


Figure 59:Farm ranking. Author's elaboration. Source: FLOS OLEI

It is important to analyze the data because the judgment of the experts is one of the key points in the hedonic price model. In fact, the findings regarding this variable will provide knowledge about the role of the experts' ranking in the formation of the market price for the extra-virgin olive oil.

In the dataset, the oldest founded farms seem to be the most appreciated by the experts. In Figure 43, it is noticed that, in percentage terms, 67% of the farms were founded before 1980, compared to the others, receiving the "Really excellent" and "Excellent" score. The most recent ones are concentrated in the range of "Good" and "Very Good".

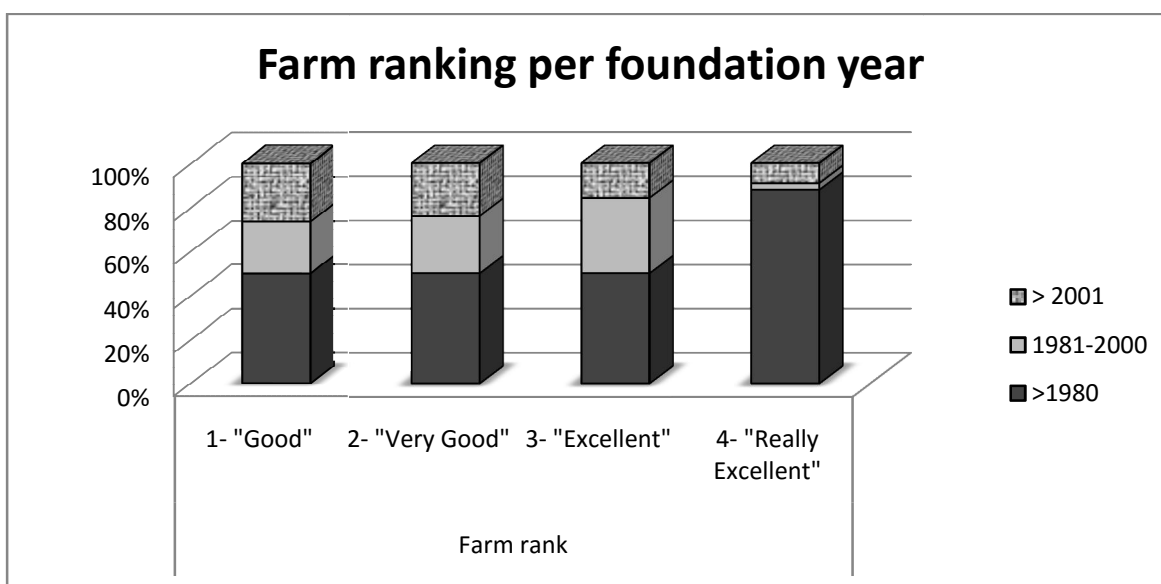


Figure 60:Farm ranking per foundation year. Author's elaboration. Source: FLOS OLEI

From this analysis it can be assumed that the EVOO coming from farms that are on the market for many years have developed a certain reputation. Farms appear to need some time to establish a reputation at the high-end olive oil market.

Looking at the score given to those olive oils that received the “Eco-sustainability” award, and hence to those farms that followed sustainable practices in the farm’s operation, as shown in Fig. 61, it is possible to observe that they are receiving a higher grade in the point scale of 90-100 (49% of the observed sample).

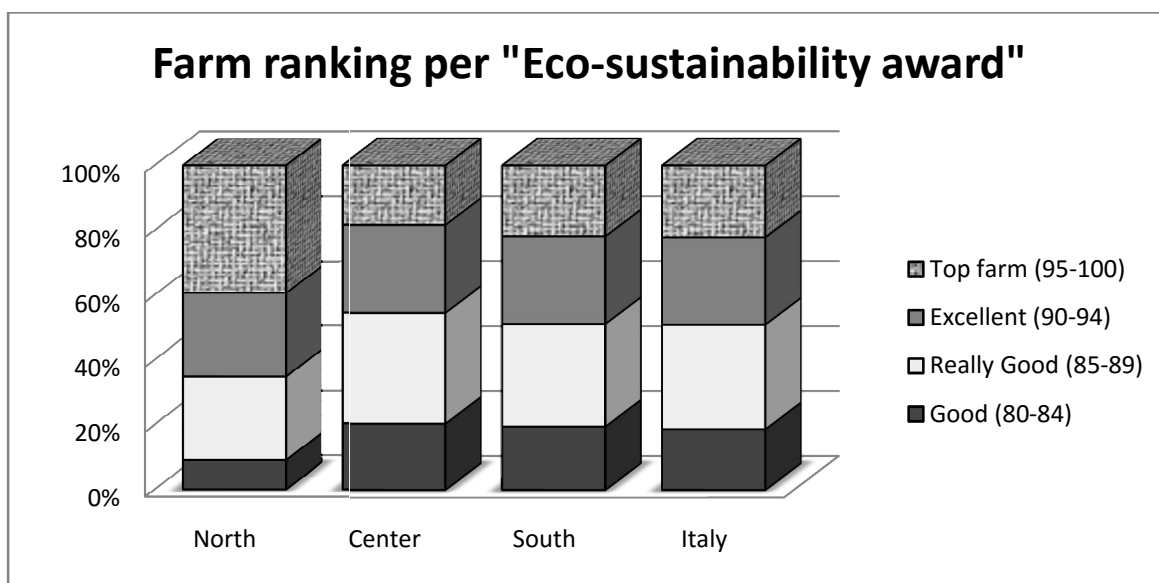


Figure 61: Farm ranking per “Eco-sustainability Award”. Author’s elaboration. Source: FLOS OLEI

Analyzing the data per macro area, in the Northern and Central areas, the farms that followed the good practices are receiving a higher grade (“top farm”) in the percentage of 39%, while in the Southern part this figure is 22%.

For the opinion of the experts, not only the quality of the olive oil, but also the farm practices are an important element for the final judgment.

The other awards given to those farms considered excellent in terms of care and respect for the environment are rewarded positively by the experts. This is confirmed by the fact that the excellence of the farm is receiving additional mentions. For example, the farms that are awarded with the “Made with love farm” prize are receiving simultaneously the highest grades, as also noticed before. In this case the idea is strengthened by the concentration of value around the “top” Farms (54%).

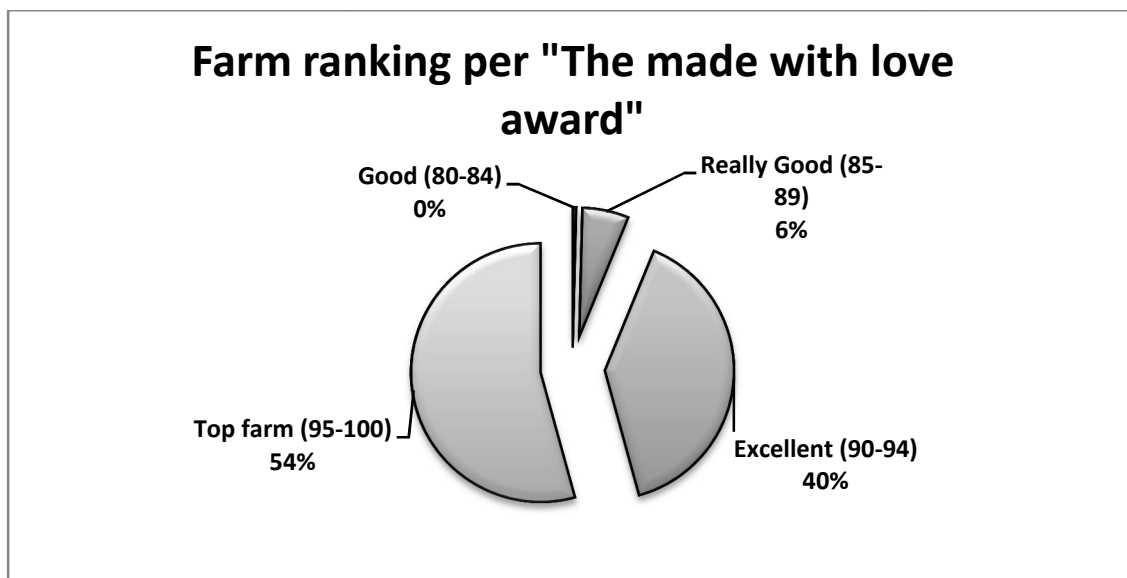


Figure 62: Farm ranking per “Made with Love” award. Author’s elaboration. Source: FLOS OLEI

3.5.3.8 Farm ranking and presence in one or more years

An instrumental variable included is whenever the reviewed farm was present one or two years before and received at least a score of 90 or more. In the annual regression the combined effect in terms of price premium of a high score will be considered (in detail: “Excellent” or “Top farm”/ “Really Excellent”) and the presence of two (for 2014) or three considered years (for 2015).

Considering 2014, the farms present for two consecutive years with a higher score ranking, represent 57% of the total farms reviewed. In detail they represented the 39% (for the 90-94 ranking) and 18% (95-100 ranking) of the farms reviewed in the considered year.

For 2015, the farms present for three consecutive years represent 58% of the sample of the considered year, counting 40% for the 90-94 point scale and 19% for the highest ranking.

3.5.4 Attributes related to the geographical origin

3.5.4.1 Macro-areas

One aspect to consider in the study is the influence of the region of origin of the EVOO on the price, since in Italy there are differences in terms of climate and composition. It is

worth remembering that there exists an important connection between the area of origin and the EVOO, especially for Italian consumers. The consumer associates flavors, traditions and cultural habits to the place of origin. The place of origin may influence the quality of the olive oil. The quality of the olive oil depends in fact not only on the variety chosen for producing the oil but also on the area of origin, in terms of climatic conditions and soil composition.

The size of the farm is strongly linked to the macro-area where the farm is located. Considering the hectares for macro areas, it is possible to perceive the different composition in farm size in the sample.

The Northern area is characterized by smaller farms. 37% of the farms from this macro-area have a size of less than 5 hectares. The situation is different in the other macro-areas. In the Central area, 38% of the farms have a size less than 15 hectares, and 25% are below 30 Ha. In the Southern part the largest farms are present. In fact, 37% of the considered sample has an area greater than 15 hectares.

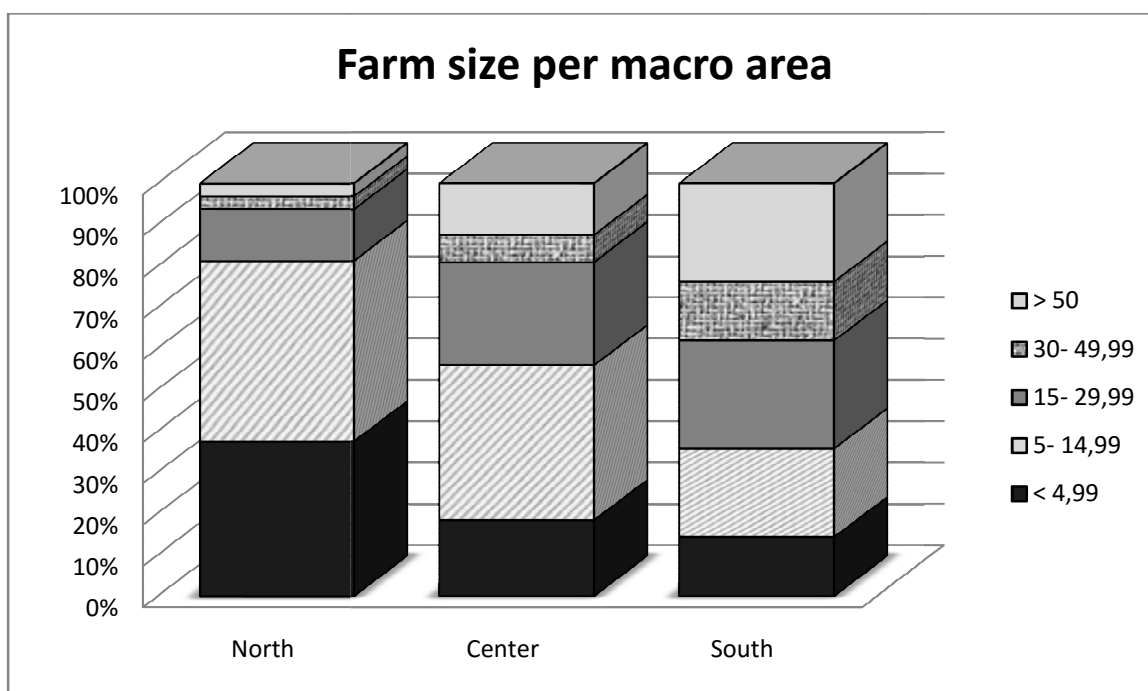


Figure 63:Farm size per macro area. Author's elaboration. Source: FLOS OLEI

3.5.4.2 EU Geographical Indications (GIs)

The farms reviewed that decide to produce under the European certification represent in total 34.2% of the observations. Of these, a majority is choosing the PDO certification

(78%), instead of the PGI. All of the PGI certifications come from Toscana, with the only indication being “Toscano PGI”. This is inevitable since there is only one PGI certification in Italy. For this reason it was decided to merge these two certifications in order to evaluate if a price premium is associated to the EVOO produced under the European Certifications compare to those without. The GI EVOOs are reported to be 27% of the considered sample, while the remaining percentage of the analyzed EVOOs (73%) are producing without the certification of origin.

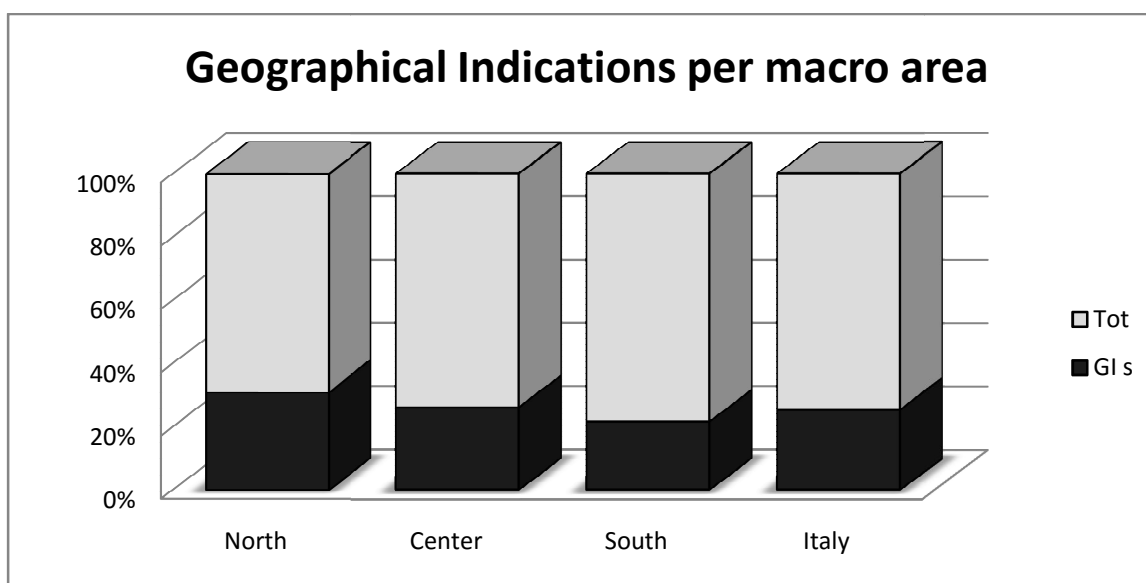


Figure 64. Geographical Indications per macro-area. Author’s elaboration. Source: FLOS OLEI.

Excluding Tuscany, that represents the whole production of PGI EVOOs, considering the farms that produce under the European certification. In most of the regions in the sample, the farms have chosen to produce under the European certification. In particular, in the Central-Southern areas, the presence of designations of origin is predominant (59% and 25% respectively). In regions such as Lazio and Sicily (that has the highest number of PDO EVOO recognitions) this percentage is around 10%, while in the North the average percentage drops below 4%, excluding the Veneto region (7%).

Among the three considered years the composition of farms with Geographical Indication has changed. Looking at the macro area level, the number of GI EVOOs in the Northern and Southern area has declined in favour of the Central one, due most probably to an increase in the production year 2013/14 of the main certified producers of this area (Toscano PGI +22% and Sabina PDO 36%), while for the South a decline in Terre di Bari

PDO (-17%) was registered that represents the main Italian GI EVOO in terms of produced quantities (Qualivita-Ismea, 2014). It also has to be considered at the individual level that a farm can decide from one year to another to sell under the EU PDO- PGI quality scheme or not. This may occur in the case of a year with low quality, in order not to compromise the reputation of the EVOO.

As mentioned before, reputation is established over the years. From the analysis of the variables in the study it is observed that the older farms, with a better reputation, prefer to rely more on European certification, compared to the new ones.

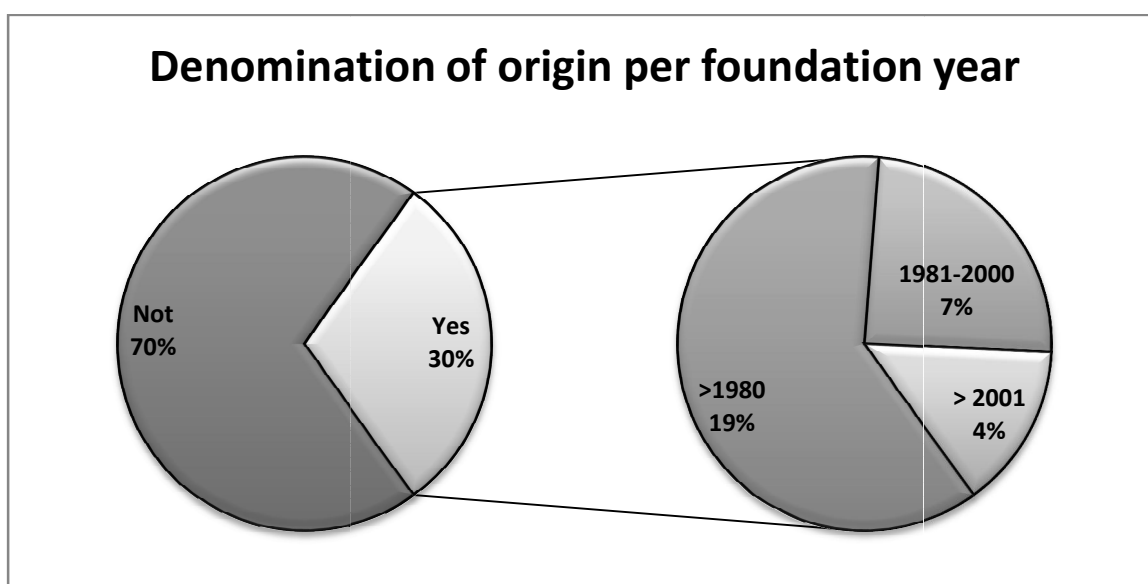


Figure 65: Denomination of origin per foundation year. Author's elaboration. Source: FLOS OLEI

According to Figure 66, it is possible to notice that almost two thirds of the GI EVOOs are in the medium taste category, while a discrete percentage of them (13%) has an intense taste. A residual percentage is for the light fruity taste category with 10% of the cases.

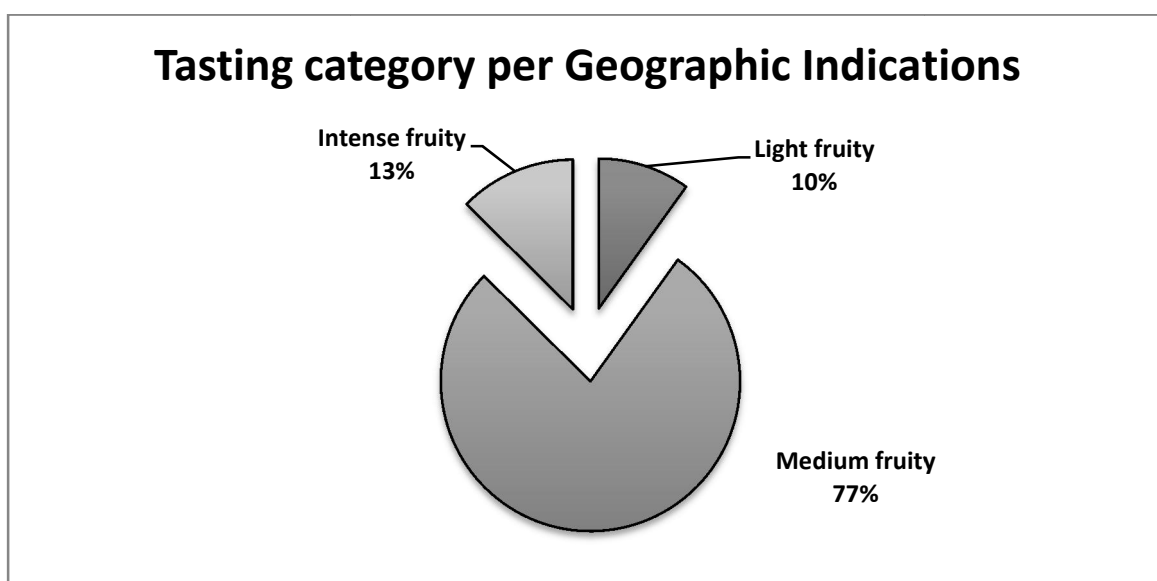


Figure 66: Tasting category per denomination of origin. Author's elaboration. Source: FLOS OLEI

The EVOOs produced under European Certification are awarded with a medium ranking. In percentage terms, farms that are choosing the PDO-PGI certification obtain a rank between “Really good” and “Excellent” in 61% of the cases, while about one third of these (17%) are obtaining a score equal to or greater than 95.

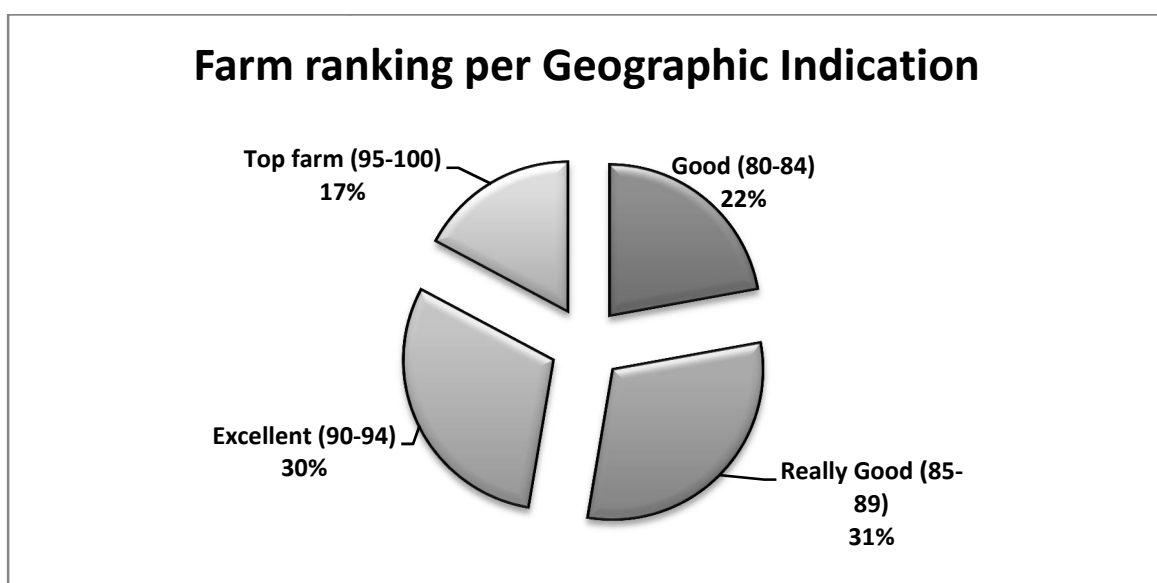


Figure 67: Denomination of origin per farm ranking. Author's elaboration. Source: FLOS OLEI

Farms that decide to produce under Geographical Indications have lower production than the others in the sample. In detail, the farms that produce under PDO-PGI certification

have yields of olives per tree of less than 0.1 tons, accounting for 47% of the certified production.

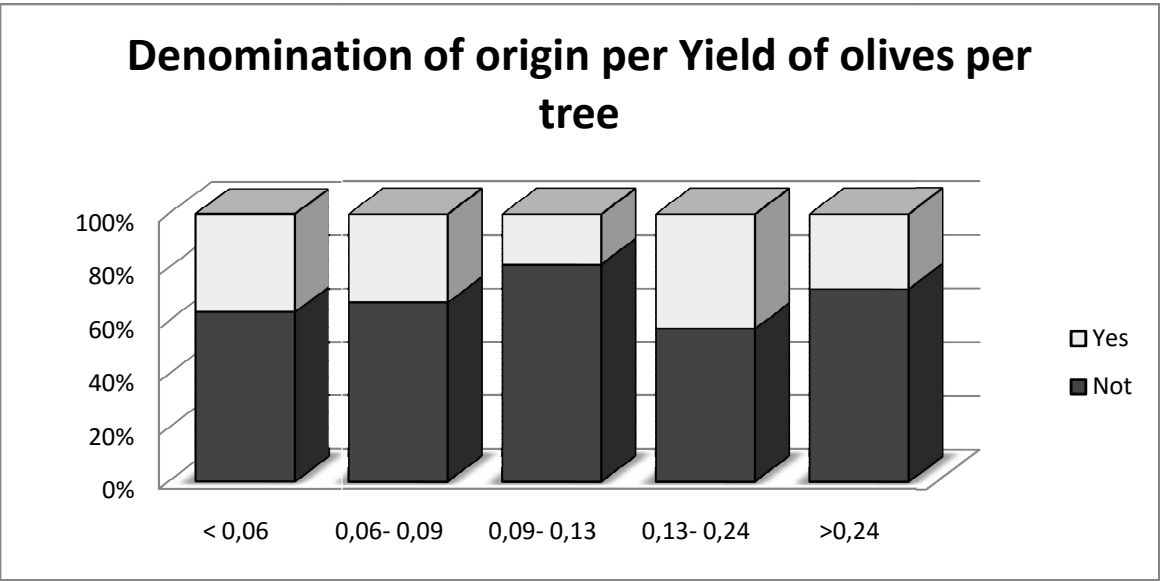


Figure 68:Denomination of origin per yield of olives per tree. Author’s elaboration. Source: FLOS OLEI

CHAPTER 4:

RESULTS

4.1 The quality variables and their role in the model

In this chapter results obtained from the hedonic price model are presented. The variables chosen for the final model will be briefly presented (see also chapter 3, section 3.5). This includes summary statistics of the annual panel datasets; this will guide the reader in better understanding the results obtained. Afterwards, the results obtained will be presented and discussed. Lastly, a comparison with a recent work by Cacchiarelli et al. (2015b), this is quite comparable to the present analysis, at least to some extent, and thus the comparison will add insights on possible trends that are observed in different segments of the Italian olive oil market.

In order to estimate the role of different quality clues in the price formation of the EVOO, for the regression, the following equation was built:

$$\text{Log } P_{\text{EVOO}} = \alpha_0 + \alpha_1 \text{tastingcat} + \alpha_2 \text{bottlesize} + \alpha_3 \text{Monovariety} + \alpha_4 \text{Localvarieties} + \alpha_5 \text{Coop} + \alpha_6 \text{Prod} + \alpha_7 \text{OlivesPurch} + \alpha_8 \text{FarmRank} + \alpha_9 \text{Eco} + \alpha_{10} \text{Org} + \alpha_{11} \text{Harv} + \alpha_{12} \text{Mill} + \alpha_{13} \text{Area} + \alpha_{14} \text{GIs}$$

(Equation 16)

where:

$\text{Log } P_{\text{EVOO}}$ is the logarithm of the price released by values;

Tastingcat is the tasting category;

Bottlesize represents the size of the bottle;

Variety denotes if the EVOO is made by one variety (monovarietal olive oil);

Localvarieties indicates the local diffusion of the varieties;

Coop indicates the type of farm;

Prod refers to the total annual production of the farm;

Olivepurch considers if the farm buys olives outside the farm in measures equal to or greater than 50% of the total olives processed in the farm;

Farmrank indicates the expert grade given by the experts from 80 to 100¹⁶;

Eco considers if the farm receives the eco-sustainability award given by the experts;

Org indicates if the EVOO comes from organic farming;

Harv indicates if the farm harvests in the traditional way (hand picking/beating or mechanically);

Mill is the presence of an onsite mill;

Area refers to the geographical origin defined at the macro-area level (North, Centre or South of Italy);

GIs indicates the presence of the Geographical Indication of origin (both PDO and PGI).

Table4.1 contains all the variables present in the dataset, and the frequencies associated distinguishing between annual and panel data.

¹⁶It is worthwhile to remind that in the annual regressions for years 2014 and 2015 the presence of the farm in the Guide as well as the score obtained were taken into account; with respect to the score, only farms that got more 90-95 points (High Rank) and those that were graded more than 95 (Top Farm) were included.

Table 4.1. Descriptive statistics for the variables

Variables	2013		2014		2015		3 years	
	Obs	Freq	Obs	Freq	Obs	Freq	Obs	Freq
Price €/liter								
6,01-12	17	7,1	21	7,8	14	5,4	52	6,8
12,01-15	45	18,9	34	12,6	38	14,6	117	15,3
15,01-18	47	19,7	55	20,4	55	21,2	157	20,5
18,01-22	38	16	55	20,4	53	20,4	146	19
22,01-27	45	18,9	59	21,9	50	19,2	154	20,1
27,01 -65	45	18,9	45	16,7	49	18,8	139	18,1
Light fruity taste	21	8,8	25	9,3	16	6,2	62	8,1
Medium fruity taste	187	78,6	201	74,7	195	75	583	76
Intense fruity taste	30	12,6	43	16	49	18,8	122	15,9
Bottle size 250	12	5	17	6,3	18	6,9	47	6,1
Bottle size 500	217	91,2	243	90,3	235	90,4	695	90,6
Bottle size 750	9	3,8	9	3,3	7	2,7	25	3,3
Local Varieties	172	72,3	178	66,2	169	65	519	67,7
1 variety	112	47,1	132	49,1	126	48,5	370	48,1
Cooperative	24	10,1	23	8,6	20	7,7	67	8,7
Prod <34HI	85	35,7	106	39,4	93	35,8		
Prod 35- 134 HI	74	31,1	80	29,7	85	32,7		
Prod 135-235HI	20	8,4	21	7,8	23	8,8		
Prod 236-335 HI	10	4,2	16	5,9	17	6,5		
Prod >336 HI	49	20,6	46	17,1	42	16,2		
Olives purchased >50%	48	20,2	49	18,2	45	17,3	142	18,5
Farm rank 1 (80-84)	49	20,6	68	25,3	54	20,8	171	22,3
Farm rank 2 (85-89)	84	35,3	84	31,2	93	35,8	261	34
Farm rank 3 (90-94)	67	28,2	68	25,3	60	23,1	195	25,4
Farm rank 4 (95-100)	40	16,8	49	18,2	53	20,4	142	18,5
High Rank (90-94)+ 2 years			107	39,8				
Top Farm (95-100)+2 years			48	17,8				
High Rank (90-94)+ 3 years					49	18,8		
Top Farm (95-100)+3 years					104	40		
Ecosustainability Award	155	65,1	184	68,4	185	71,2	524	68,3
EVO from organic Farming	73	30,7	80	29,7	87	33,5	240	31,3
Hand picking and beating	118	49,6	142	52,8	130	50	390	50,8
Farmoliveoilmill	123	51,7	130	48,3	126	48,5	379	49,4
North	31	13	32	11,9	26	10	89	11,6
Center	130	54,6	153	56,9	156	60	439	57,2
South	77	32,4	84	31,2	78	30	239	31,2
GIs	92	38,7	85	31,6	85	32,7	262	34,2
ToT Observations	238	100	269	100	260	100	767	100

Source: Author's elaboration.

4.2 Descriptive statistics for panel data analysis

Preliminary, for the panel data analysis, a *between* as well as a *within* variation measures were calculated for detecting, respectively, the time invariant variables and the time variant ones present in the dataset built from the three- years observations.

Table 4.2-a: Descriptive statistics panel data: Product attributes

Variable	Variation	Mean	Std. Dev.	Min	Max	Observations
Farm	overall	202	116	1	402	N = 1206
	between		116	1	402	n = 402
	within		0	202	202	T = 3
Price €/Lt	overall	23,01	9,37	6	65,01	N = 767
	between		8,82	6	56,01	n = 402
	within		2,84	5	42,34	T-bar = 1,91
Product attributes						
Bottle size	overall	493	76	250	750	N = 767
	between		71	250	750	n = 402
	within		33	243	743	T-bar = 1,91
Bottle Size 250	overall	0,06	0,239	0	1	N = 767
	between		0,2246	0	1	n = 402
	within		0,008	-0,61	0,72	T-bar = 1,91
Bottle Size 500	overall	0,91	0,29	0	1	N = 767
	between		0,27	0	1	n = 402
	within		0,12	0,2394	1,57	T-bar = 1,91
Bottle Size 750	overall	0,03	0,18	0	1	N = 767
	between		0,17	0	1	n = 402
	within		0,09	-0,63	0,69	T-bar = 1,91
Tasting category	overall	2	0,48	1	3	N = 767
	between		0,48	1	3	n = 402
	within		0,1	141,16	341,16	T-bar = 1,91
Light fruity	overall	0,08	0,27	0	1	N = 767
	between		0,29	0	1	n = 402
	within		0,05	-0,59	0,58	T-bar = 1,91
Medium fruity	overall	0,76	0,43	0	1	N = 767
	between		0,43	0	1	n = 402
	within		0,08	0,09	1,42	T-bar = 1,91
Intense fruity	overall	0,16	0,4	0	1	N = 767
	between		0,35	0	1	n = 402
	within		0,08	-0,51	0,82	T-bar = 1,91
Local varieties	overall	0,68	0,47	0	1	N = 767
	between		0,45	0	1	n = 402
	within		0,15	0,01	1	T-bar = 1,91
1 variety	overall	0,48	0,5	0	1	N = 767
	between		0,48	0	1	n = 402
	within		0,18	-0,19	1	T-bar = 1,91

Source: Author's elaboration.

Table 4.2-bDescriptive statistics panel data: Farm and production process attributes

Farm and production process attributes						
Variable	Variation	Mean	Std. Dev.	Min	Max	Observations
Cooperative	overall	0,09	0,29	0	1	N = 761
	between		0,26	0	1	n = 398
	within		0	0,09	0	T-bar = 1,91
Tot. Olive oil Prod.	overall	231,61	483,68	1	4500	N = 767
	between		470,21	2	4500	n = 402
	within		88,04	-659,71	1428	T-bar = 1,91
Prod <34 HI	overall	0,37	0,48	0	1	N = 767
	between		0,47	0	1	n = 402
	within		0,15	0,3	1,04	T-bar = 1,91
Prod 35-134 HI	overall	0,31	0,46	0	1	N = 767
	between		0,43	0	1	n = 402
	within		0,2	-0,36	0,98	T-bar = 1,91
Prod135-235 HI	overall	0,08	0,28	0	1	N = 767
	between		0,25	0	1	n = 402
	within		0,13	-0,58	0,75	T-bar = 1,91
Prod 236-335 HI	overall	0,57	0,23	0	1	N = 767
	between		0,17	0	1	n = 402
	within		0,12	-0,61	0,72	T-bar = 1,91
Olive oil prod >336 HI	overall	0,18	0,38	0	1	N = 767
	between		0,36	0	1	n = 402
	within		0,1	-0,49	0,85	T-bar = 1,91
Purchased olives >50%	overall	0,11	0,31	0	1	N = 763
	between		0,29	0	1	n = 400
	within		0,07	-0,56	1	T-bar = 1,91
Farm ranking (89-100)	overall	89	4,84	80	98	N = 767
	between		4,61	80	98	n = 402
	within		0,83	84	93	T-bar = 1,91
Farm rank 80-84	overall	0,229	0,42	0	1	N = 767
	between		0,45	0	1	n = 402
	within		0,11	-0,44	0,88	T-bar = 1,91
Farm rank 85-89	overall					
	between		0,46	0	1	n = 402
	within		0,16	-0,33	1	T-bar = 1,91
Farm rank 90-94	overall	0,25	0,44	0	3	N = 767
	between		0,37	0	1,66	n = 402
	within		0,18	-0,41	1,58	T-bar = 1,91
Top farm 95-100	overall	0,19	0,39	0	1	N = 767
	between		0,31	0	1	n = 402
	within		0,12	-0,48	0,85	T-bar = 1,91
Eco Award	overall	0,68	0,47	0	1	N = 767
	between		0,46	0	1	n = 402
	within		0,17	0,17	1,34	T-bar = 1,91
EVOO from Organic	overall	0,31	0,49	0	1	N = 767
	between		0,45	0	1	n = 402
	within		0,13	-0,35	0,98	T-bar = 1,91
Hand Picking Harv	overall	0,52	0,49	0	1	N = 767
	between		0,5	0	1	n = 402
	within		0	0,52	0,52	T-bar = 1,91
Farm mill	overall	0,5	0,5	0	1	N = 767
	between		0,5	0	1	n = 402
	within		0	0,5	0,5	T-bar = 1,91

Source: Author's elaboration.

Table 4.2-cDescriptive statistics panel data: Geographical origin attributes

Geographical origin attributes						
Variable	Variation	Mean	Std. Dev.	Min	Max	Observations
North	overall	0,11	0,32	0	1	N = 1206
	between		0,32	0	1	n = 402
	within		0	0,11	0,11	T = 3
Center	overall	0,57	0,5	0	1	N = 1206
	between		0,5	0	1	n = 402
	within		0	0,57	0,57	T = 3
South	overall	0,32	0,47	0	1	N = 1206
	between		0,47	0	1	n = 402
	within		0	0,32	0,32	T = 3
GIs	overall	0,34	0,47	0	1	N = 767
	between		0,46	0	1	n = 402
	within		0,15	0	1,01	T-bar = 1,91
PDO	overall	0,27	0,45	0	1	N = 767
	between		0,43	0	1	n = 402
	within		0,14	-0,39	0,94	T-bar = 1,91
PGI	overall	0,07	0,25	0	1	N = 767
	between		0,26	0	1	n = 402
	within		0,04	-0,6	0,4	T-bar = 1,91

Source: Author's elaboration.

The *between* variation is referred to the variability across individuals (in our case the farms) in the time-point considered, while the *within* one regards the variability that may occur in the same farm at different times.

Time- invariant variables are those that are not changing over time and have positive between variation and zero within variation. In the sample these variables are: type of farm (cooperative or not), the presence of an onsite mill, the hand picking and beating way of harvest and the macro-areas.

With regards to time variant variables, all the considered ones have, as normal and expected ,a greater *between* variations than *within*. This is mainly related to the structural characteristics of the farms. In fact, in a short period of time, such as the considered ones, the behaviours of the farms remain almost stable. For example, the olive oil produced with the local plant varieties shows a stable trend as well as the bottle size chosen, that shows low within variability (with values concentrated in the medium range - 500ml), while

among the taste category there is found, in the sample, a preference for a medium-intense taste.

Despite the short time span considered, some farms, however, show a change in their behaviour. For example, regarding the choice to produce a mono-varietal EVOO, in the sample a tendency of the farms is observed of promoting these kinds of olive oil. This reflects a recent trend observed in the market of producing and promoting the mono-varietal olive oil. On the same positive trend the choice is made by each farm to produce under the European Geographical Indications (a tendency is shown for the PDO, rather than the PGI European scheme) and the organic farming. Contrarily, an opposite tendency it is shown for the olive oil produced with the local plant varieties, and about the purchase of olives in large amounts, outside the farm.

Also too be noticed, is the positive *within variation* among the farm ranking, especially for those present in the guide with more than a year, in the excellence category (95-100 points scale), is worth noting. Analyzing the *farm ranking* given by the experts it is noticed that none of the farms reviewed achieves the maximum score (99-100). In the panel data regression, the presence in two or more years cannot be considered, since these kinds of models consider already if the farm is present in more than a year. In fact, with the panel analysis it is possible to study the variability among the individuals over time, and at the same time (in the case of the random effects model), the variability across the farms.

4.3 Results of the estimations of the hedonic price model

Before analyzing the estimation of the model, the outcome of a preliminary test, that has been done in order to choose the better functional form, will be presented. This is the Ramsey's RESET test that was performed in order to test and choose among the different functional forms, which has been used in previous work in the application of hedonic price modelling. Preliminarily, the selection between the different functional forms was restricted to the linear and log-linear functional form, in order to allow an interpretation of the estimated parameters in terms of price elasticity (Brentari & Levaggi, 2009). The linear specification of the functional form was rejected for the regression 2014 and 2015, while for 2013 it was not possible to detect the miss specification. Hence, the log-linear

specification was employed among all the models, in order to compare the different annual regression estimations.

Table 4.3-a. Ramsey RESET test

Ramsey RESET test using powers of the fitted value of Price €/Liter		
<i>2013</i>	<i>2014</i>	<i>2015</i>
F(3, 211) = 1,87 Prob > F = 0,1361	F(3, 244) = 3,14 Prob > F = 0,0153	F(3, 231) = 4,94 Prob > F = 0,0024

Source: Author's elaboration.

Consistent with previous literature (Carlucci et al., 2014; Cabrera et al., 2015) the equation for all the three considered years was estimated in semi-logarithmic form, including all the previously mentioned variables. In this way, the assumptions under the Ordinary Least Square (OLS) were satisfied. It should be remembered that the characteristics of the built dataset allow the running of the separate regressions for each considered year, and a general one for all the considered period of time. Therefore, a panel data model has been set up in order to examine the variation in the price formation over time and to understand and capture the farm level heterogeneity among the sample. For the panel data analysis, two conventional approaches were employed: fixed and random ones.

In Tables 4.3-b – 4.3-d, the full model is presented when all the variables selected are included, for both annual and panel regression analysis, with the specification of random and fixed effect models. For the sake of comparison, a pooled regression was estimated, treating the panel as cross-sectional observations.

Hence, the results under the full models will be discussed.

Table 4.3-b. The regression model: Product attributes

Variables	2013		2014		2015		OLS Pooled		Random Effects		Fixed effects	
Bottle Size 500	-0,32	***	-0,31	***	-0,31	***	-0,31	***	-0,31	***	-0,32	***
	(-3.66)		(-4.28)		(-4.59)		(-7.26)		(-7.61)		(-5.77)	
Bottle Size 750	-0,35	*	-0,48	***	-0,4	***	-0,4	***	-0,37	***	-0,37	***
	(-2.54)		(-4.57)		(-3.42)		(-6.12)		(-6.41)		(-4.89)	
Local Variety	-0,12	*	-0,09		-0,06		-0,09	***	-0,05		0,02	
	(-2.30)		(-1.79)		(-1.43)		(-3.51)		(-1.78)		(0.48)	
Mono variety	0		0,02		0,1	*	0,05		0,05	*	0,06	
	(0.08)		(0.41)		(2.05)		(1.64)		(2.02)		(1.77)	
Light fruity	-0,21	*	-0,18	*	-0,17		-0,18	***	-0,14	*	0,01	
	(-2.18)		(-2.07)		(-1.81)		(-3.45)		(-2.23)		(0.09)	
Medium fruity	-0,08		-0,08		-0,04		-0,06		-0,06		0,01	
	(-1.17)		(-1.35)		(-0.71)		(-1.72)		(-1.54)		(0.12)	

Source: Author's elaboration.

In log/linear transformation the coefficients are reported after the exponential transformation.

***, **, * = Significant at least at 1, 5 and 10% respectively

Table 4.3-c. The regression model: Farm and processing attributes

Variables	2013		2014		2015		OLS Pooled		Random Effects		Fixed effects	
Cooperative	0,03		0,03		0		0,01		0,02		0	
	(0.36)		(0.33)		(-0.03)		(0.28)		(0.26)		(.)	
Olive oil prod <34 HI	0,13		0,24	**	0,07		0,15	**	0,14	**	0,05	**
	(1.53)		(2.81)		(0.84)		(3.30)		(2.66)		(0.60)	
Olive oil Prod 35-134 HI	0,19	*	0,25	**	0,11		0,2	***	0,17	***	0,09	***
	(2.47)		(3.10)		(1.53)		(4.54)		(3.61)		(1.22)	
Olive oil prod 135-235 HI	0,29	*	0,25	*	0,03		0,17	**	0,07		-0,03	
	(2.58)		(2.37)		(0.31)		(2.99)		(1.37)		(-0.39)	
Olive oil prod 236-335 HI	-0,01		0,03		0,06		0,04		0,04		0	
	(-0.06)		(0.32)		(0.59)		(0.64)		(0.81)		(0.04)	
Purchased olives >50%	0,01		-0,05		-0,07		-0,03		-0,03		-0,08	
	(0.17)		(-0.70)		(-0.86)		(-0.72)		(-0.66)		(-1.02)	
Ecosustainability Award	-0,02		0,03		0,07		0,03		0,03		0,06	
	(-0.43)		(0.65)		(1.50)		(0.92)		(1.17)		(1.70)	
EVOO from Organic farm	-0,03		-0,08		-0,08		-0,07	**	-0,02		0,02	
	(-0.51)		(-1.77)		(-1.91)		(-2.73)		(-0.78)		(0.35)	
Hand Picking	0,18	***	0,1	*	0,12	*	0,14	***	0,14	***	0	
	(3.52)		(2.15)		(2.54)		(5.33)		(4.01)		(.)	
Farm Olive oil mill	0,07		0,06		-0,01		0,05		0,02		0	
	(1.22)		(1.08)		(-0.18)		(1.49)		(0.51)		(.)	
Farm ranking (89-100)	0,02	***					0,02	***	0,02	***	0,03	***
	(3.39)						(6.18)		(5.25)		(3.43)	
HighRank(90-94)+ 2 years			0,05									
			(0.92)									
Top Farm (95-100)+ 2 years			0,14									
			(1.75)									
HighRank (90-94)+ 3 years					0,04							
					(0.83)							
Top farm (95-100)+ 3 years					0,17	*						
					(2.30)							

Source: Author's elaboration.

In log/linear transformation the coefficients are reported after the exponential transformation.

***, **, * = Significant at least at 1, 5 and 10% respectively

Table 4.3-d. The regression model: Geographical origin attributes

Variables	2013		2014		2015		OLS Pooled		Random Effects		Fixed effects	
North	0,76	***	0,45	***	0,58	***	0,57	***	0,56	***	0	
	(6.75)		(4.50)		(5.44)		(9.65)		(7.24)		(.)	
Center	0,24	***	0,12	*	0,28	***	0,2	***	0,24	***	0	
	(3.79)		(2.14)		(4.68)		(5.97)		(5.45)		(.)	
Geographical Indications	0,02		0,09		0,07		0,07	*	0,05		0,02	
	(0.31)		(1.78)		(1.41)		(2.41)		(1.86)		(0.39)	
_cons	1,56	**	3,13	***	3,07	***	1,61	***	1,55	***	1,06	
	(3.19)		(22.13)		(24.28)		(6.37)		(5.16)		(1.56)	

Source: Author's elaboration.

In log/linear transformation the coefficients are reported after the exponential transformation.

***, **, * = Significant at least at 1, 5 and 10% respectively

Table 4.3-e. The regression model: Post estimations results

Variables	2013		2014		2015		OLS Pooled		Random Effects		Fixed effects	
N	235		269		256		757		757		757	
N groups									396		396	
F test	6,41	***	5,43	***	6,09	***	18,89	***	258,82	***	5,16	***
Wald Chi2												
R ²	0,37		0,32		0,35		0,34		0,33		0,14	
Adj R ²	0,32		0,26		0,3		0,32					
RootMSE	0,3448		0,3402		0,3204		0,3277					
R2 within									0,158		0,1828	
R2 between									0,335		0,1049	
VIF	1,53		1,62		1,59							
Sigma u (α)									0,29		0,3651	
Sigma e									0,16		0,1569	
Rho									0,77		0,844	

Source: Author's elaboration.

In log/linear transformation the coefficients are reported after the exponential transformation.

***, **, * = Significant at least at 1, 5 and 10% respectively

With regard to the choice of the better model specification for panel data analysis, different tests were employed.

Firstly, the Breusch and Pagan Lagrangian multiplier test (Breusch & Pagan, 1980) was performed in order to see if the random model is adapted better than the pooled one. The

result leads to acceptance of the null hypothesis indicating that for the scope of the present study, the random effects performs better compared to the pooled OLS one.

Table 4.3-f. Breusch and Pagan Lagrangian multiplier

<i>Breusch and Pagan Lagrangian multiplier test for random effects</i>
Test: $\text{Var}(u) = 0$
Chibar2(01) = 271.57
Prob > chibar2 = 0.0000

Source: Author's elaboration.

The result was, actually, expected, since in the use of panel data analysis, the aim is to investigate the behaviour of each unit for a repeated period of time, and not consider them as random cross-section data.

In relation to the choice between random and fixed effects models, the Hausman test was performed. The p-value (greater than 0.05%) validates the null hypothesis of reliability of the random effects model.

Table 4.3-g. Hausman Specification test

<i>Hausman specification test</i>
Test: <i>Ho: difference in coefficients not systematic</i>
b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg
chi2(16) = (b-B)'[(V_b V_B)^(1)](bB) = 19.46
Prob>chi2 = 0.1935

Source: Author's elaboration.

This result can be explained by observing that the fixed effects model fails to estimate the time-invariant variables, such as those related to the *area of origin*, the *type of farm*, the *harvesting method* and the presence of a *farm mill*, which, in the study of the role of different quality clues in the price formation of EVOO, represents important factors to be considered. As shown in Table 4.3-h below, the main differences among random and fixed

effect models are those related to the *tasting category*, the *local varieties* and the *organic farming*. This can find an explanation in the group-level *endogeneity*, and hence in the influence of the omitted variables¹⁷. The strong territorial root that characterized the olive oil also has to be considered, and hence, the effect of the exclusion of the macro-areas in the fixed effects model.

Table 4.3-h. Hausman specification test: differences among the Fixed and the Random effects model

Hausman specification test				
Coefficients	(b)	(B)	sqrt(diag(V_b-V_B))	
	Fixed	Random	Difference	S.E.
Size500	-0,39	-0,37	-0,02	0,05
Size750	-0,46	-0,46	0	0,06
Local varieties	0,02	-0,05	0,07	0,03
1 variety	0,01	0,05	-0,04	0,02
Light fruity	0,01	-0,14	0,15	0,14
Medium fruity	0,01	-0,06	0,07	0,07
EVOO Prod <34 HI	0,05	0,13	-0,08	0,06
EVOO Prod 35-134 HI	0,09	0,15	-0,07	0,06
EVOO Prod 135-235 HI	-0,03	0,07	-0,09	0,05
EVOO Prod 236-335 HI	0	0,04	-0,04	0,04
Purchased olives >50%	-0,08	-0,03	-0,05	0,07
Farm ranking (89-100)	0,03	0,02	0,01	0,01
Ecosustainability Award	0,05	0,03	0,02	0,02
EVOO from Organic farming	0,01	-0,02	0,04	0,03
Geographical Indications	0,02	0,05	-0,03	0,03

Source: author's elaboration on results obtained in Stata 13.

Since the random effects model is more appropriated than the fixed effects and the pooled models, it will be discussed as a final model.

Overall, both models were highly significant: the p-value was less than <0.01 using the standard F-statistic for the OLS and the fixed effects model. For the random effect model

¹⁷For the random effect s models

Wald's chi square test shows significant results as well. Hence, it is possible to conclude that the variables used are improving the model.

Variance inflation factors (VIF) were calculated for each annual regression in order to check the adequacy of the model. The VIF test indicates, in all the cases, evidence of absence of *multi-collinearity* (VIF values < 10.0).

The results across the dataset show robustness and indicate the characteristics that affect EVOO price appreciably. In fact, observing the overall fit of the model, the R^2 shows similar values (0.37 for 2013, 0.32 for 2014, 0.35 for 2015 and for the panel, 0.34 for the pooled regression and 0.33 for the random effects model). Overall, good results for these kinds of estimations are observed, in line with values obtained in the previous studies for extra-virgin olive oil (Cabrera et al., 2015; Cacchiarelli et al., 2015b). It should be noted that the annual regression in 2013 refers to the 2011/12 production year, 2014 to the 2012/13 season and so forth.

Regarding the fixed effects model, the R^2 seems to be much smaller than the others, due to the fact that with this analysis, the variables that are not changing over time are omitted from the regression. In fact the *area of origin*, the type of farm (*cooperative* or not), the *harvesting method* and the presence of a *farm mill* are counted as time-invariant characteristics. The R^2 shows that the fixed and random effects estimators can explain 16%-18% of the within variation.

For what concerns the post estimation results of the panel data analysis, as it possible to observe in the dedicate table, Rho that represents the variance interclass correlation, shows that the proportion of the variation, for the majority, is explained by the individual specific term (77% and 84% for the random and the fixed effects model, respectively), and for the rest by the idiosyncratic error. Sigma u (α) that represents the standard deviation *within* groups for the random effects model is 0.29, which means that the random effects model is closer to the OLS regression rather than the fixed effects model, that has a value of 0.37.

The results are divided into the three different levels of analysis, in order to specify and show the effects of each attribute on the consumer's preferences and, as a consequence, in terms of price premium. Figures 52, 53, 54 and 55 show the estimated coefficient, as a percentage, for each attributes group. The coefficients are expressed as partial elasticity on

the regressed one, (i.e. *ceteris paribus percentage variations*). For each level, the results are present as the average of the estimated coefficients of the annual OLS regressions. The results are presented below in this way, and not showing separately each annual result as well as panel regressions, to avoid repetition and to highlight the possible differences, if observed. The main variables in the annual regressions as well as those in the random effects model are significant, and the goodness of fit is higher. However, some of the variables considered in the study do not significantly affect the regressor. We argue that The main reason in this case can be found in the low number of observations.

4.3.1 Attributes related to the product

To begin within relation to the product attributes, in all the models¹⁸, the variable related to the bottle size shows a significant value . As expected, a smaller bottle size fetches a higher premium.

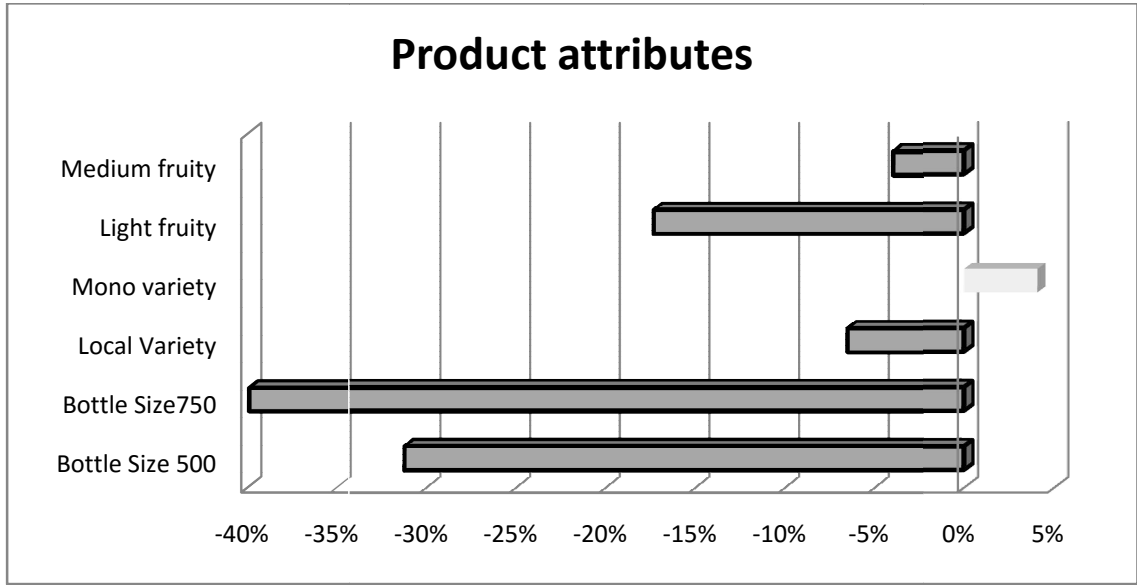


Figure 69: Estimated coefficient related to the product attributes. Source: Author’s elaboration.

*The grey bars without border lines denote that the coefficients are not statistically significant.

Compared to the 250 ml bottle size, used as a benchmark, it is observed that the 500 ml bottle size is associated with a negative and significant premium price (PP) of 31%¹⁹ while the 750 ml has a negative price premium of about 40%²⁰, as expected. The higher negative

¹⁸Both annual and panel data models.

¹⁹ The coefficient is statistical significant at a level of 1%.in all the estimated models.

²⁰ In all the estimated models the level of significance is 1%, except for 2013, when it is 5%.

price premium indicates that the price decreases as the bottle size enlarges. In fact, the inverse relationship that exists between the price and the size of the bottle is confirmed, and this can be explained in terms of perception of quality.

The local olive varieties specified for only some of the olive oils included in the Flos Olei guide seems to be univocally associated with a negative price premium (on average 6% and significant at 10% for only the first considered year²¹).

Looking at the results coming from the monovarietal olive oil, the estimated coefficient is associated with an average positive price premium of about 4%. However this is not significant, except for the 2015 regression. In this year the price premium grows up to 10%, and shows a significant value (10%). Furthermore, it should be emphasized that in the panel data analysis, the random effects model detects a positive and significant price premium of about 5 %.

Taste significantly affects price in this market segment, In fact, the FLos Olei tasting categories affect price as follows :using the intense taste category as benchmark, the light and the medium tasting oils are associated with an average negative price premium of 17%²²and 4%²³, respectively. However, the intermediate category does not show significant coefficients probably due to its closeness to the intense fruity one. The taste of the oil strongly depends on the plant variety of the olives as well as on climate, soil and on the method of production: all features, in turn, related to the region of origin.

4.3.2 Attributes related to the farm and production process

Among attributes expressing farm and production process characteristics , no statistical influence emerges in the case of being a cooperative.

²¹2013 OLS regression. A significant coefficient is shown also for the pooled regression model. In this case the observed PP is -9%, and the coefficient is statistically significant at the level of 1%.

²²-0.21 (2013), -0.18 (2014) and -0.17 (2015) OLS regression and statistically significant at the level of 10%.

²³-0.08 for 2013 and 2014 while a decrease of 4% was recorded in 2015.

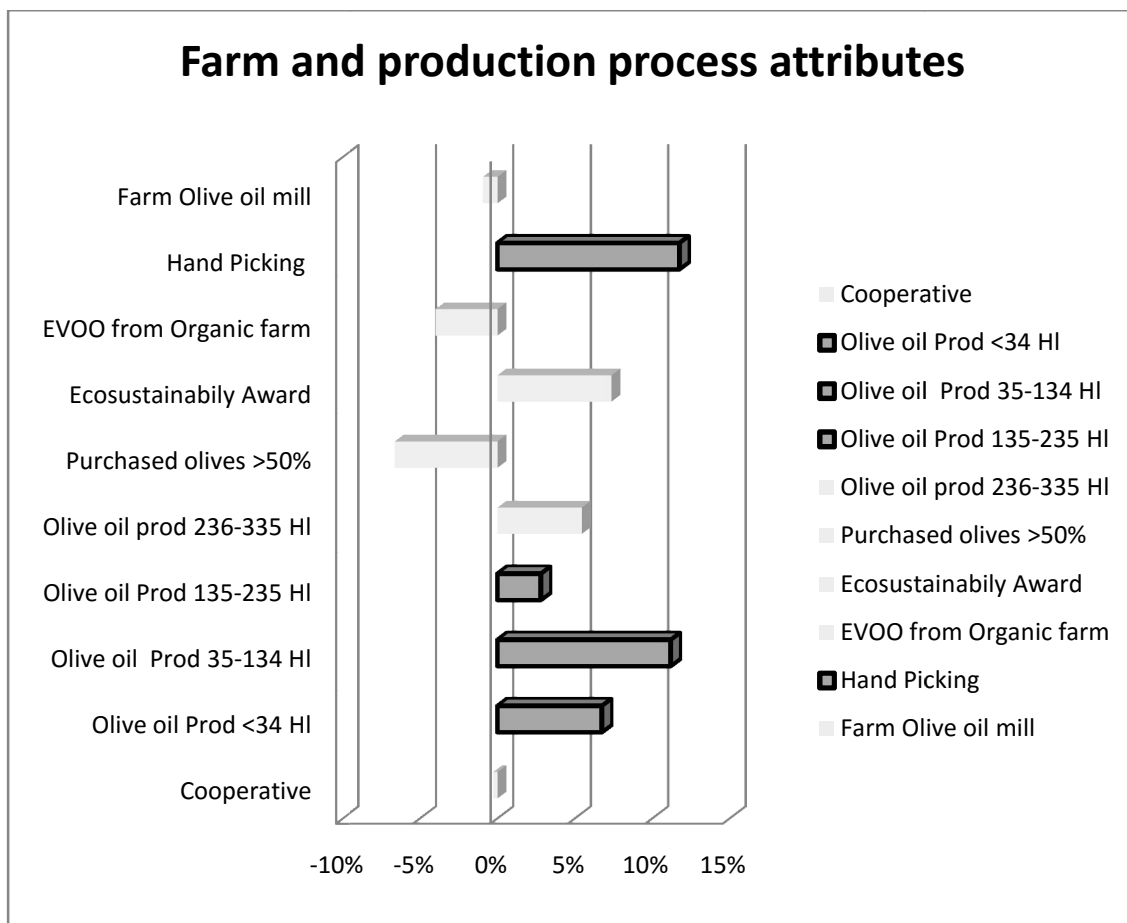


Figure 70: Estimated coefficient related to the farm and production process attributes. Source: Author's elaboration.

*The grey bars without border lines denote that the coefficients are not statistically significant.

Cases where the olive oil is produced in the in-farm mill are associated with non significant coefficients²⁴ across all the considered models.

A positive price premium is associated for the annual regression, with the traditional method of harvesting. Using mechanical harvesting as a benchmark, on average a price premium of 13%²⁵ is associated with the hand picking and beating method.

Interestingly, the analysis of the variable is related to the production of olive oil per farm, shows the expected sign. In fact, using the last dimensional class (the bigger one) as a

²⁴ 1% for the 2013 OLS annual regression as well as the random effects ones, while for the 2014 and 2015 regression the significant level is 10%.

benchmark, the impact is positive. In detail, while for the 2013 and 2014 regression the values show significant coefficients, for the 2015 one, the produced volume does not seem to play any role in the price formation. In addition the fourth category (from 135 to 235 Hl) shows no significant results in all three considered years, as well as in the panel data analysis. The observed price premiums referring to 2013 are as follows: 29% for the third one, 19% for the second one, and 13% for the observed first one (the smallest categories show no significant coefficient). Regarding 2014, the OLS regression shows more mitigated different values, though still significant : the same PP of 25% is observed for the third and size classes, while the smallest ones obtain a PP of 24%. The random effects analysis confirms that the two smallest categories are associated with a positive and significant PP of 17% (production volumes from 35 to 134 Hl) and 14% (from 0 to 34Hl).

Considering the volume of olives purchased by the farms in a percentage equal or superior to 50%, a negative price premium of 5% for 2014 regression and 7% for the 2015 is observed while there is a null impact of the estimated parameter for 2013 OLS, and no significant results among all the models. In the panel data analysis the negative price premium is confirmed (-3%), but still not significant. The results coming from the analysis of the eco-sustainability award do not show significant values among all the annual regressions, as well as the panel data analysis. However, these results, from a knowledge point of view, give some indications about the consumers in the high quality market that seems to be sensitive to environmental issues and the local tradition. In fact the farms that receive this award are showing a positive price premium of 3%²⁶, and 7% for 2015, except for 2013 in which this award has a negative influence of about 2%.

Taking as a benchmark the conventional production, a negative price premium, but not a significant one, is related to the organic production (on average -4%). This can be explained by the fact that the consumers do not associate this attribute with a high quality olive oil. However, in the fixed effect estimation, the results show a positive price premium of about 2%, and can be considered as a result of the exclusion of the macro-areas from the regression. Indeed, the climatic composition of the Country has to be considered. The high temperature as well as the low level of rainfall in the South makes organic farming difficult, since crops are more susceptible to the attack of specific

²⁶For 2014 and the random effects analysis.

parasites. Organic farming is preferred in colder climates due to the strict legislation that does not allow the use of pesticides for parasites, which find an ideal climate in the mild temperatures of the Southern areas. This means that in colder climate avoiding pesticides is less problematic than in warmer ones and thus, Organic production rules are more often a viable option in Central and Northern Italian Regions.

Among farm and production process attributes, apart from the group of variables already presented mention is made on expert judgment and the presence in the guide for more than one edition. To the best knowledge of the author, variables as such were never included in similar hedonic price in the field of the EVOO. The evaluation of the experts prove to be an important price driver. The grade given to the farms reviewed in the guide has a positive and significant impact (1%) on the premium price of 2%²⁷. The result is confirmed by the positive impact coming from the random effects model that detected a positive and significant variation (1%) among the considered years for the experts' rating. In fact, each additional year in the guide with a rank above the average for individuals lead to a positive price premium of 2%. Looking deeper, in the annual regressions, the farms that received higher score (95-100 points scale) and are recognized with excellence among the others²⁸ with a presence of more than a year, are rewarded with a positive price premium of 14% (being reviewed for 2 years) and 17%²⁹ (three years), compared to the previous and lowest point scale (90-94). In this case, the PP shows a positive but not significant impact of about 5% and 4% respectively for 2014 and 2015.

²⁷ For the 2013 OLS regression, only the farm ranking was considered since it was not possible to know the presence of those farms in previous years.

²⁸ Ranking equal to or greater than 95 on the point scale.

²⁹ Significant at 1%.

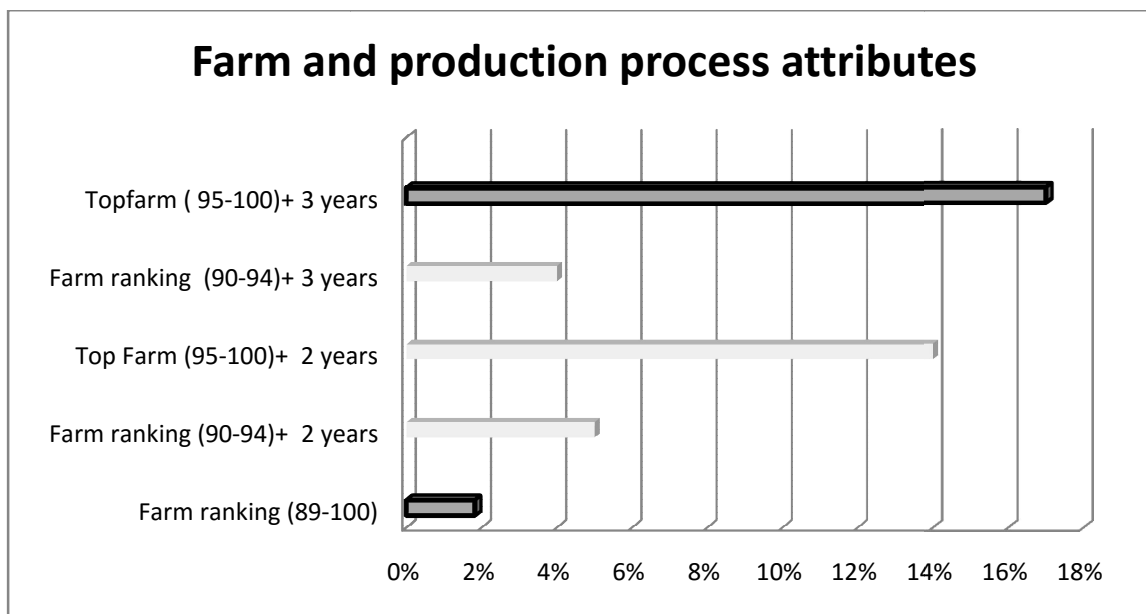


Figure 71. Estimated coefficient related to the farm and production process attributes. Source: Author's elaboration.

*The grey bars without border lines denote that the coefficients are not statistically significant.

4.3.3 Attributes related to the geographic origin

The final aspect analyzed regards the place of origin (specified as 3 groups of Regions: Northern, Central and Southern) and the presence of the GIs. These two variables were built in the model to specify, respectively, the area of origin and its certification, and to study their effects on the premium price.

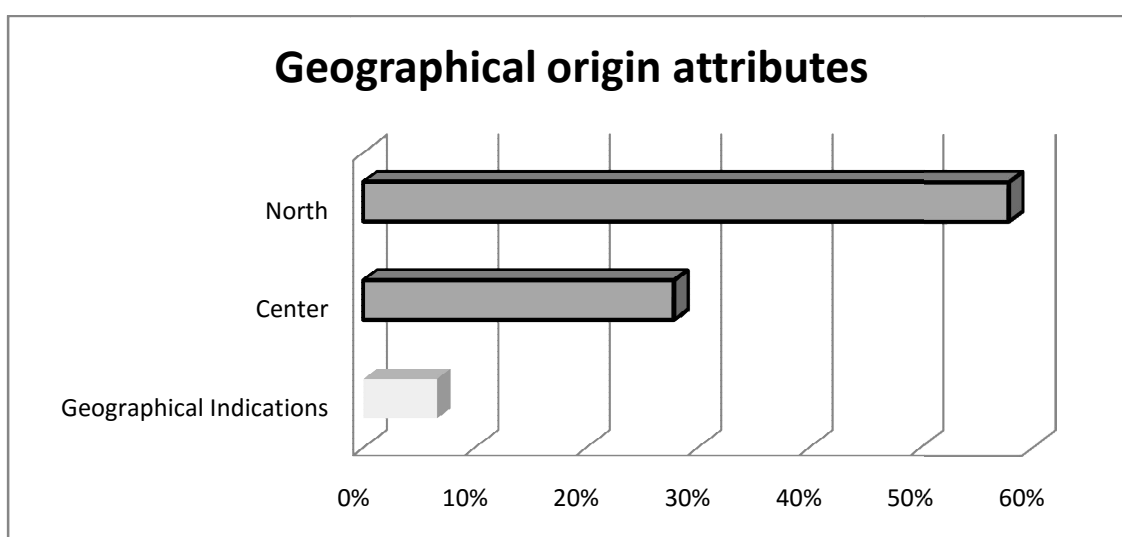


Figure 72. Estimated coefficient related to the geographical origin attributes. Source: Author's elaboration.

*The grey bars without border line denote that the coefficients are not statistically significant.

The individual regions of origin (i.e. Tuscany, Puglia, etc.) were excluded due to the *multicollinearity* problems, probably due to the overlapping of the presence of the denomination of origin and some GI (in particular Tuscany and Umbria denote both the Region and the GI that have exactly the same extension). However, by including in the study the denominations of origin, it is possible to observe whenever the reputation related to the place of origin is able to influence the price or not. As already mentioned, the distinction between the Protected Denomination of Origin (PDO) and the Protected Geographical Indication (PGI) were excluded, due to the fact that the only PGI certification for olive oil in Italy is represented by the “Toscano PGI”.

Among the area of origin, the Northern and the Central areas command a premium price of 58% and 28% respectively, over the Southern one and significant for all the considered models (1%). For the Central Regions, in 2014, the price premium was less than the average (12%). This can be related to the composition of the sample. In fact, in the 2014 sample the observations coming from the two important regions (Umbria and Tuscany) of this macro-area were less compared to the last considered year (2015).

It is important to mention that the premium price associated with the presence of the EU Geographical Indication, considered a sign of quality, doesn't show a significant coefficients, even if this feature has a positive price premium of about 7%. The limited number of products with GIs in the dataset can explain this result (in fact even if the OLS pooled regression was excluded, the GI variable in that regression had a significant value), as already seen in the work of Cabrera et al. (2015).

4.3.4 EVOO: a comparison between Italian guides

The analyzed EVOOs in the study belong to a niche market. To better understand the results and trace the differences and similarities between different segments of the Italian olive oil market it is appropriate to mention in a dedicated paragraph the recent study conducted by Cacchiarelli et al. (2015b).

This study was focused on a of the Italian market, using a different guide: the one edited by Slow Food (2013). The selected guides refer to two different market segments. Slow Food is intended for medium segment of the Italian olive oil market, while Flos Olei to a high segment. This can be seen immediately by looking at the descriptive statistics proposed in the table 4.3-j. The different compositions in terms of sample will help to explain the estimated results.

Table 4.3-i Descriptive statistics for the two studies³⁰

<i>Variables</i>	<i>Flos Olei*</i>		<i>Slow Food*</i>	
	<i>Obs</i>	<i>Freq. %</i>	<i>Obs</i>	<i>Freq. %</i>
Price €/lt				
6,01-12	17	7	241	24
12,01-15	45	19	162	16
15,01-18	47	20	212	21
18,01-22	38	16	147	15
22,01-27	45	19	104	10
27,01-65	45	19	140	14
Product attributes				
Size 250ml	47	6	30	3
Size 500ml	695	91	583	58
Size 750ml	25	3	329	33
Size 1 Lt	0	0	59	5
LocalVariety	519	68	748	74
1 variety	370	48	503	5
Farm and Production process attributes				
Cooperative	67	9	135	13
Farm olive oil prod <50 Hl	366	48	567	56
Farm olive oil prod 51-100Hl	113	15	155	15
Farm olive oil prod 101-500Hl	200	26	95	9
Farm olive oil prod >501 Hl	88	11	191	19
EVOO from organic Farming	240	31	475	47
Hand picking Harv Method	390	51	778	77
Farm mill	379	49	395	39
Geographical origin				
North	89	12	148	15
Center	439	57	364	36
South	239	31	496	49
Geographical Indications	262	34		
PDO	210	27	159	16
PGI	53	7	0	0
ToT Observations	767	100	1008	100

Author's elaboration. Sources: FLOS OLEI 2013,2014,2015 and Cacchiarelli et al. (2015b)

³⁰The FlosOlei data refer to 3 consecutive years, while Slow Food data refer only to 2013.

The first distinction can be found in the analyzed market: in fact, this is a medium-high segment for Cacchiarelli et al. (2015b) – (the average price per liter was about 18 €); while in Flos Olei the market can be defined as a niche (high-end, with an average price of 23 €/liter). In detail the majority of olive oils (40%) reviewed by the Slow Food guide fits into the price range between 6 -15 €/Lt, while for Flos Olei the 38% of the EVOO is in the range between 2201 and 65 €/Lt.

The differences in terms of studied segments can also be found among others aspects of the collected sample. While in the first one, the composition of the farms, in terms of macro-area, respects the proportion observed in the Italian pattern (49% of the farms are from the Southern part of the country), in the last one, the majority of the farms are coming from the Central area (57% of the sample). Some differences are also observed for the Geographical Indications. While in this work, the Protected Denominations of Origin represent 27% of the total EVOOs, in the study of Cacchiarelli et al. (2015b) this percentage drops to 16%. The same can be observed regarding the organic production. While in this study organic farming represents 31% of the sample, in Cacchiarelli et al. (2015b) the percentage is about 47%.

There are also similarity between the two studies. In terms of farms cooperatives, in the considered work, the frequency differs slightly by about 4% (9% against 13% of the total sample), as well as the presence of a farm mill.

This reinforces the idea of a niche market, since from the selection of the rewarded farms, , it was decided to include in both guides more small and/or family run farms/mills: 1) the annual production of olive oil for both study, are concentrated in the range from 1 to 100 Hl (67% and 71%), due to a probably choice of represent the farms production respect to the industrial one; 2) The hand picking harvesting method is chosen in both studies in the majority of the case (51% in Flos Olei and 77% in Slow Food).

Switching to another aspect, the mono varietal EVOOs represents the 50% of the total observations, as well as the local varieties (68% in Flos Olei and 74% in Slow Food). Regarding the bottle size, both studies use the 500ml bottle size for the majority of the EVOOs. It is worth mentioning that while in the “Slow Food Guide” EVOOs are present as 1 liter bottles, in “FlosOlei” this is not the case, and this reinforces the idea of exclusivity of the olive oils chosen in the latter and the peculiar market analyzed. This is due also to

the different market in which the two guides operate. While Slow Food is aimed at a wider audience (in fact the guide can be purchased in book shops), the Flos Olei guide is addressed mainly to sector operators, such as middlemen, importers/exporters and other buyers, restaurant managers, chefs and so forth; while only a minority of very expert consumers particularly careful to the quality.

The results coming from the mentioned study confirm the relevant impact of the area of origin as price driver. The EVOOs coming from the Northern and Central part of Italy demonstrate to be superior in terms of quality in the eyes of the consumers. However, while in the study of Cacchiarelli et al. (2015b), the Geographical Indications show a slightly positive and significant value, for the highest market segment, the coefficient, as reported in the results of the regression, does not. The reasons can be several. The farms that produce a high quality olive oil can perceive the Geographical Indications as a homologation system. In fact a producer of a high quality EVOO may rely more on his reputation and private label. Also, consider that the reviewed farms from Flos Olei come from local contexts and maybe are not interested in the promotion of their olive oil through the GIs systems.

From the analysis of the two studies, it emerges that for the EVOO, the location has a stronger impact on the price formation and prevails with respect to the Geographical Indications.

Among the attributes related to the product, both studies pinpoint the new tendencies of the market versus the mono-varietal olive oils, for both this is quite a relevant price driver (10% in both studies, even if significant in this study only for the last considered year³¹).

A negative correlation between local varieties and premium price is detected in both studies. In fact the national and regional plant tree varieties are preferred to the local ones, that in the highest segment of the market in both studies have a slightly negative impact on the price. These results confirm the idea of a lack of knowledge on the side of the final consumers for the local varieties, since the mono-varietal (produced for the majority with local varieties) is associated with a positive PP.

31 2015 OLS regression

The important and positive role of small bottles in associating to a significant price premium is confirmed in both estimations.

In relation to the farm and processing attributes, the cooperatives in both studies show no significant estimated parameter. As pointed out by Cacchiarelli et al. (2015b), while the prices are in the highest range, the price premium seems to be negative and significant. From this, it is possible to find similarities with the wine market, where the cooperatives are specialized in the production of low quality products (Roma et, 2012), while the analyzed EVOOs are in a medium-high segment. The farm's producers specialized in the high-end segment rely more on the reputation and the private label to be in the cooperative. In support of this, small annual volumes produced are rewarded by a positive price premium, with respect to the industrial one. In both studies, no statistical impact emerges in the case of a presence of a private mill. However, the estimated parameters turn out to be positive in the highest segment in the market. Moving on to the results about organic olive oil they seem to suggest that this feature is associated with a positive price premium of about 7% in the work of Cacchiarelli, while in this study in the annual regression there is a negative price premium of about 4%. However, the results coming from the panel data analysis (fixed effects model) seem to suggest a different behaviour, and a slightly positive price premium of about 2%. The results can be interpreted as follows: since the studies refer to different segments of the market, it is possible that in a niche market, other features are more likely to emerge.

On the contrary the way of harvesting the olive and the results from the organic production differ from the two studies. In fact while in Cacchiarelli et al. (2015b), the hand picking and beating harvesting method has a negative impact on the price, in this study, it is associated with a positive price premium. The same happens for the organic olive oil, since in this study a negative price premium of about 5% is detected. The most probable reason can be found in the different market's segment: while for the medium-high segment the organic EVOOs seem to be positive attributes, for the high-end segment other attributes are more likely to emerge.

The mentioned studies provide evidence that the olive oil market is undergoing a process of sophistication, as has already happened in the past for wine. In fact, in the studies

analyzed more and more similarities can be found for both products, especially in the medium-high market segments.

CHAPTER 5:

CONCLUDING REMARKS

This final chapter integrates what has been shown throughout the previous chapters. First, it summarises briefly the aim of the research and its main results while comparing them with those repeated in similar studies. Some of the results are further discussed with the goal of deriving some implications in terms of marketing strategies and policy measures

The aim of this research was to assess the market value of different quality attributes in high-end segments of the Italian EVOO market. In a differentiated market, knowledge about which variables impact on the price level give useful insights not only to the producers, but also to all operators along the production chain. Marketing strategies based on the knowledge of these features are essential to those farms interested in adding value to their product in a differentiated market that is getting more and more sophisticated.

To meet this goal, the study builds a hedonic price model which allows to estimate the relationship between price and different quality clues. In other words, each quality feature is associated with a price premium, everything being equal (Rosen, 1974; Thrane, 2004).

This method has been largely applied to food products, while recently, it has also been applied to extra-virgin olive oil, although in only very few cases. This market is becoming more diversified as the product loses its connotation of commodity and becomes a basic everyday life standardised condiment. The process is also pushed by the increase in the international trade of olive oil, with consumers from non-traditionally producing countries that are increasingly interested in this product and in some cases consider it, to some extent, as a so called *luxury* food.

Based on data gathered from the International guide “Flos Olei”, for three consecutive years, data were selected and variables were built following previous works in the field of olive oil.

The dataset built allows to obtain information on different attributes of EVOO, which have been grouped into three main categories: attributes related to the product, features related to the farm and to the production process, and those related to the geographical origin.

For the first group of variables the information related to extra-virgin olive oil was used such as the bottle size, tasting category and varieties used, distinguished in terms of numbers (one or more plant varieties) and their geographical distribution: national or local.

The second category grouped all the information about the farm, such as annual production expressed in hectolitres, external supplies of olives, presence of a cooperative, organic farming, presence of an onsite mill, harvesting method (traditional or mechanical) and if the farm is following eco-sustainability practices.

In this group, the farm's ranking was also integrated as given by various experts, and as a novelty from the previous literature, with the presence in the guide for more than a year.

In the third group were incorporated all those variables related to the geographical origin of the EVOOs, the farms as distinguished at the macro area level, and the presence of a Geographical Indication of Origin.

Previous studies based on the application of the hedonic price model to the olive oil market have investigated the effects of only some of these variables within some of the above-mentioned categories. Conversely, in this study a hedonic price model was built including all the main categories of attributes, in order to have a better evaluation about their importance in the EVOO price. This has been made possible from the use of an expert guide that looks at different aspects, not only relating to the product as such, but also to those relating to the farm and the processing process. In addition, using the expert guide for three consecutive years made it possible to investigate the role of the expert grade and the advantage, in terms of price premium, of being rewarded for more years. To the best knowledge of the author, none of the previous studies have evaluated either the role of experts' judgment or being reviewed for more consecutive years. Furthermore, since in this study, data covers several consecutive years, a panel data analysis, besides the annual OLS estimations, was also conducted, in order to study the behaviour of those farms across time, using a fixed effects model and a random one.

As argued by Ockzowsky (1994), the results of the hedonic price model can be used in the short term to improve the labelling and advertising strategies of the firms. In the long run, the result may help the decision makers to assess the most relevant and potentially rewarding investments, such as the plant varieties (with reference to the understated sector

to be used) and the production-processing system. In light of these reflections, this study can provide information about which features should be included on the label, choosing information that can have a positive impact on the purchase behaviour.

Similar to previous studies, the price of the EVOOs is a reflection of the geographical origin. The provenience of the olive oil appears to play an important role in the formation of the price, in the high-end segment of the market. In this study, olive oils from Northern and Central areas were worth more compared with products from Southern areas. The Italian territory is highly heterogeneous in terms of soil and climate, and these factors confer to the olive oil qualities that are appreciated among the consumers. In addition to the heritage, skills and tradition, the reputation effects strongly emerge. The results support the hypothesis of a relation between place of origin and perceived product quality (Ribeiro & Santos, 2004; Karipidis et al., 2005; Cicia et al., 2013; Cabrera et al., 2014; Carlucci et al., 2014; Cacchiarelli et al., 2015b). In light of these results, it is undergoing a differentiation strategy based on quality, increasingly adopted by producers located in the Northern and Central Regions.

It is interesting to note that, similarly to previous studies, GIs do not show any significant impact on price. In several works on oil olive for traditionally producing countries the same result is obtained: Cabrera et al. (2015) for the Spanish market, Aprile et al. (2012), van der Lans et al. (2001), and Scarpa and Del Giudice (2004) for Italy, and Fotopoulos and Krystallis (2012) for Greece. A possible explanation for this is that the olive oil, differently from other agricultural products such as wine, is bought once per year in a local market. This implies that direct personal relationships are more valued compared to the guarantee offered by the GIs. Furthermore, small producers that seek to reach further consumers may choose to be included individually, rather than collectively through the GI scheme.

The study confirmed that consumers are interested not only in the features directly related to the product, but also those related to the production process. The study has assessed the value of products coming from small (Cacchiarelli et al., 2015b), vertically integrated farms with an onsite mill and following a traditional harvesting process. The natural way of production, as underlined by Ribeiro & Santos (2004), may have a positive impact on the perceived quality of the EVOO. The major consideration at this point is that the consumers

are showing a preference for olive oil produced following the traditional method, since the traditional production process is appreciated compared to the industrial process.

The mono-varietal olive oil seems to be perceived positively, as a recent trend observed in the Italian market, in line with previous works (Carlucci et al., 2014), and can be used, in a sophisticated market, as a tool of promotion of the geographical origin based on the plant varieties. In fact, the demand for olive oils with well-defined *organoleptic*, nutritional and commercial characteristics has recently re-evaluated the function of the plant varieties as an element that contributes to the qualification of olive production.

Differently, local varieties are perceived negatively, even if most of the mono-varietal olive oils are produced with local plant varieties. While in the wine market, the grape variety represents one of the major attributes able to influence the price (Roma et al., 2013; Cacchiarelli et al., 2014b), for olive it seems that other quality clues are more likely to prevail. The negative price premium of local plant varieties in the olive oil market can be explained by a lack of knowledge of the final consumers regarding the local varieties. This is most probably related to a lack of awareness on the part of consumers about the diffusion of the plant varieties. Farms and all other operators should take this into consideration, during the labelling and advertising decisions, including for example the indication in the label of the plant varieties used, and the sensory and *organoleptic* characteristics conferred by the use of a specific variety and the suggested pairings with dishes. In fact, although customers cannot know the taste before the purchase, they can use the description present on the label on the bottle as a driver of their choice.

In line with previous studies (Karipidis et al., 2005; Cicia et al., 2013; Cabrera et al., 2015), we found that the size of the bottle is inversely related with the price, indicating that using small bottles is a rewarding marketing strategy for producers. As demonstrated in previous studies (Ribeiro & Santos, 2004; Karipidis et al., 2005; Cicia et al., 2013), consumers associate the smaller size of the bottle with an olive oil of higher quality especially in the higher segment of the market (Di Vita et al., 2013). At the same time, a sense of exclusivity is attributed to smaller bottles.

Important also are the sensory features. The intense flavour of olive oil is strongly linked to the quality of EVOO and higher price premiums are associated compared to medium and light tastes (Karipidis et al. 2005; Cicia et al., 2013) It seems that Italian consumers are

positively sensitive to the intense taste, due to the knowledge as well as the culinary habits about a defined taste of olive oil that accompanies seasoned dishes. A bitter sensory profile can be one of the most important descriptors for particular EVOOs (Recchia et al., 2006). This seems to be quite different from previous literature on olive oil. As evidenced by Delgado & Guinard (2011) and Del Giudice et al. (2015), new non-traditional consumers prefer a neutral taste, while it seems that experts are inclined to consider positively EVOOs with strong and pungent fruity aroma, as noted by Cicia et al. (2013).

The method of harvesting by the farms yields interesting results. The positive result obtained for the hand picking and beating harvesting methods can be interpreted as follows: The natural way of harvesting improves the perceived quality of the olive oil, and therefore the perceived value to the final consumers. This method seems to be preferred by consumers possibly because it confers a finer and more sophisticated taste.

It is also worth recalling the results obtained for organic production. Differently from what was assumed, a negative price premium is associated to this which leads one to think that in higher segments of the market other quality features are preferred.

The results obtained from the study of the grade given by the experts offer important insights. As evidenced in this study, for an extra virgin olive oil it is important to be rewarded by experts, since this can represent a source of advantage in the long term, in a differentiated market, as already confirmed for the Italian wine market (Benfratello et al., 2009, Roma et al., 2012). In addition, recognition by the experts in the field of excellence of the Italian olive oil market can help the younger and the smaller farms to become more known to the final consumers. The consumers seem to be positively sensitive to the farm ranking given by the experts, as a signal of current and long term quality. The positive price premium associated with the presence for more than a year in the experts' guides is connected to a higher grade, which demonstrates that the role of expert guides is becoming an important way to overpass the barriers introduced by asymmetric information. However, in the olive oil market not all the farms advertise the grades they receive. These results may encourage the farms to publicize their grades in their website or on their labels. Furthermore, receiving good grades may help to construct and maintain a good reputation over time, especially for young and smaller farms, as a strategy for capturing new market opportunities and targeting them to a higher segment of the EVOO market.

In light of the above-mentioned, the olive oil market is becoming similar to the wine market, especially regarding the aspect of expert guide ratings. The established differentiated process for wine can be taken as an example for olive oil, which is facing this process more recently. This is evident in the availability of the guides, not only in terms of number, but also in terms of time. However, while more advanced wine guides are available with respect to price formation, for olive oil this is still not the case. The guides in the olive oil sector are published later compared to the commercialization of the product. In addition, as demonstrated in this study, to become established in the high-end segment for the EVOO market, a farm needs at least two years with a high grade. This can encourage farms to maintain high quality EVOOs and may also encourage other farms to strive for product excellence.

This study confirms that the formation of price for the Italian olive oil market is a complex process, where both production process and product attributes play an important role.

This research provides a useful tool for producers and all the stakeholders in the olive oil market. In fact, knowledge of the attributes preferred by the consumers suggests the implementation of new marketing strategies to be adopted, in particular for advertising and labelling. In fact, by including some information on the EVOO label, both producers and distributors may raise the added value of their product. The quality clues associated with positive implicit prices suggest the indication on the label of information that is not so commonly known, such as the harvesting method, the grade received by experts in the sector, an indication of the varieties used, as has been done recently, and if the olive oil is mono-varietal, which may be useful in order to gain a competitive advantage. This study corroborates the idea that the purchase behaviour is influenced not only by the characteristics of the olive oil, but also to a certain extent, by the farm and production process as well as the origin, which, in this study, is confirmed as one of the most important drivers of price formation. The producers have to explore new production techniques in order to offer an olive oil with rich sensory attributes as a differentiation strategy. It is possible to hypothesize that in a complex market, such as the olive oil one, in which most of the competition is based on quantity, there is the need to invest in quality in order to bring the competition to a different level, exploring new markets.

The findings of this study might contribute and give useful insights to the use of the GI scheme. The importance of the varieties, as demonstrated by the positive impact of the mono-varietal olive oil as well as the area of origin, suggest that product differentiation based on varietal heritage diversity can also be promoted by the use of the GI system. Producers should use and promote regional and varietal identity through inclusion in the discipline of native varieties. In this frame, the GI system needs to be seen as a tool for promoting the local territory and varietal heritage. In light of the results obtained, it is believed that the path to follow in the near future is for the production of olive oils with a strong sensory identity given by the rediscovery of native varieties, in accordance with what has happened for wine. However, this is a medium-long term goal, because as with all perennial crops, such as olive oil, replanting requires long lead times for the first harvest due to the biological cycle of the plant (from 5 to 10 years, depending on the olive and tree variety and the choice of production method).

In addition it would be appropriate to encourage promotion and information campaigns aimed at highlighting the characteristics of each area and to promote the image of excellence in the olive oil sector.

It will be interesting to include more characteristics in a future study, such as the production of EVOOs in terms of bottles produced and information about the market where the olive oils are sold (national or designated for foreign markets), and the levels of investments in all those activities related to promotion and advertising, in order to have a better and more complete vision of the olive oil market.

Referring to the available database, it will be appealing to include other years in the panel data analysis, when new guides will be available in the market, with the aim of having the most significant and robust results, investigations over time concerning the behaviour of the farms.

It will also be interesting to include other producer countries of olive oil, for example those coming from the Mediterranean basin, in order to seek the role of quality clues and to study possible different behaviours.

Last, it will be useful to compare these results with others coming from different sectors in the olive oil trade, or other food products such as wine, in order to study the role of

different quality clues in the creation of value for each considered segment of the market, and the degree of differentiation and sophistication of the different segments or markets.

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Appendix A

Original estimated results

Variables	OLS 2013	OLS2014	OLS2015	Pooled	Random	Fixed
Size500	-0,391 *** (-3.66)	-0,376 *** (-4.28)	-0,374 *** (-4.59)	-0,367 *** (-7.26)	-0,368 *** (-7.61)	-0,391 *** (-5.77)
Size750	-0,425 * (-2.54)	-0,657 *** (-4.57)	-0,509 *** (-3.42)	-0,517 *** (-6.12)	-0,46 *** (-6.41)	-0,463 *** (-4.89)
Localvariety	-0,127 * (-2.30)	-0,0921 (-1.79)	-0,0672 (-1.43)	-0,0993 *** (-3.51)	-0,0494 (-1.78)	0,0195 (0.48)
Monovariety	0,00432 (0.08)	0,0193 (0.41)	0,0939 * (2.05)	0,0441 (1.64)	0,0507 * (2.02)	0,0596 (1.77)
Lightfruity	-0,238 * (-2.18)	-0,203 * (-2.07)	-0,19 (-1.81)	-0,198 *** (-3.45)	-0,149 * (-2.23)	0,0146 (0.09)
Mediumfruity	-0,0851 (-1.17)	-0,0832 (-1.35)	-0,0403 (-0.71)	-0,0609 (-1.72)	-0,0634 (-1.54)	0,00982 (0.12)
Cooperative	0,0288 (0.36)	0,0266 (0.33)	-0,00275 (-0.03)	0,0129 (0.28)	0,0163 (0.26)	0 (.)
Olive oil prod <34 HI	0,12 (1.53)	0,221 ** (2.81)	0,0652 (0.84)	0,144 ** (3.30)	0,127 ** (2.66)	0,0475 (0.60)
Olive oil Prod 35-134 HI	0,177 * (2.47)	0,223 ** (3.10)	0,106 (1.53)	0,18 *** (4.54)	0,155 *** (3.61)	0,0853 (1.22)
Olive oil prod 135-235 HI	0,256 * (2.58)	0,22 * (2.37)	0,0269 (0.31)	0,154 ** (2.99)	0,0666 (1.37)	-0,0272 (-0.39)
Olive oil prod 236-335 HI	-0,00752 (-0.06)	0,0322 (0.32)	0,0572 (0.59)	0,0378 (0.64)	0,0392 (0.81)	0,00241 (0.04)
Purchased olives >50%	0,0133 (0.17)	-0,0514 (-0.70)	-0,0687 (-0.86)	-0,0306 (-0.72)	-0,0325 (-0.66)	-0,0849 (-1.02)
Ecosustainably Award	-0,0215 (-0.43)	0,0315 (0.65)	0,071 (1.50)	0,0247 (0.92)	0,0294 (1.17)	0,0595 *** (1.70)
Org	-0,0262 (-0.51)	-0,0873 (-1.77)	-0,0844 (-1.91)	-0,0727 ** (-2.73)	-0,0216 (-0.78)	0,0151 (0.35)
HandPick Harv	0,166 *** (3.52)	0,0931 * (2.15)	0,111 * (2.54)	0,133 *** (5.33)	0,133 *** (4.01)	0 (.)
Farm Olive oil mill	0,0701 (1.22)	0,0607 (1.08)	-0,00957 (-0.18)	0,0456 (1.49)	0,0196 (0.51)	0 (.)
Farm ranking (89-100)	0,018 *** (3.39)			0,0171 *** (6.18)	0,0174 *** (5.25)	0,0251 *** (3.43)
HighRank (90-94)+ 2 years		0,0515 (0.92)				
Top Farm (95-100)+ 2 years		0,133 (1.75)				
HighRank(90-94)+ 3 years			0,0439 (0.83)			
Topfarm (95-100)+ 3 years			0,16 * (2.30)			
North	0,566 *** (6.75)	0,374 *** (4.50)	0,457 *** (5.44)	0,448 *** (9.65)	0,443 *** (7.24)	0 (.)
Center	0,219 *** (3.79)	0,116 * (2.14)	0,246 *** (4.68)	0,183 *** (5.97)	0,213 *** (5.45)	0 (.)
Geographical Indications	0,016 (0.31)	0,0868 (1.78)	0,0643 (1.41)	0,0642 * (2.41)	0,0508 (1.86)	0,0163 (0.39)
_cons	1.564 ** (3.19)	3.132 *** (22.13)	3.067 *** (24.28)	1.606 *** (6.37)	1.546 *** (5.16)	1.058 *** (1.56)
N	235	269	256	757	757	757
N Groups					396	396

***, **, *Significant at least at 1,5 and 10% respectively.