

Value Chain and Typicity Analysis in Jaén Mountain Olive Oil, Spain

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1. Introduction

Agriculture faces several limitations in mountain areas, related to the existence of permanent natural handicaps, as low temperatures or steep slopes, which lead to higher costs and lower productivity than in the lowlands (Santini *et al.*, 2013). Mountain olive groves, on slopes greater than 15%, carry particular weight in Jaén (Andalusia, South Spain) as they make up 40% of the province's land under olive cultivation (CES, 2011). These types of olive groves are widely represented in the "comarcas" (counties) that correspond to Jaén's three Protected Designations of Origin (PDO) for olive oil – Sierra Cazorla, Sierra Mágina and Sierra de Segura – along with the *comarca* of Sierra Sur and, to a lesser extent, in other mountain regions of Jaén (Sierra Morena, Las Villas, El Condado, etc.) (Map 1). These types of olive groves usually involve traditional mountain orchards that are non-irrigated and low-yielding. Nowadays, they are becoming progressively marginalised economically because of the structural situation of low prices and large differences in production yields compared to intensive olive groves – 1,750 kg/ha as against 10,000 kg/ha –, and costs – €3.20/kg as against €1.30/kg according to AEMO (2012). In recent years, within an economic con-

Abstract

Traditional mountain olive groves – on slopes greater than 15%, non-irrigated and low-yielding – constitute 40% of the Jaén olive cultivation land. We estimate the profitability of the Jaén's olive oil value chain and its spatial differentiation, segmenting the analysis by: types of cultivation systems; its location in mountain or lowland areas; phases of the supply chains; and bulk and bottled oil chains. A first objective is to examine the competitive disadvantages of local mountain olive oil systems, verifying that a great majority of the mountain oils have a negative private profitability. Another objective is to prove if mountain oils present characteristics of typicity, compared to lowland oils, which may generate marketing-mix attributes that enhance obtaining differentiation-related income. Special attention is paid to designation of origin and organic farming labels.

Key words: profitability, value added, mountain farming, quality labels, olive oil.

Résumé

Les exploitations oléicoles traditionnelles dans les zones de montagne – sur des pentes supérieures à 15%, non irriguées et à faible rendement – constituent 40% du verger oléicole de Jaén. Dans ce travail, nous allons évaluer la rentabilité de la chaîne de valeur de la filière huile d'olive de Jaén et sa différenciation spatiale. L'analyse sera articulée autour des types de systèmes de culture, de la localisation en montagne ou en plaine, des étapes productives de la chaîne oléicole et des filières d'huile en vrac et en bouteille. Le premier objectif est d'examiner les désavantages concurrentiels des systèmes oléicoles locaux de montagne, confirmant une rentabilité privée négative pour la grande majorité d'entre eux. Le deuxième objectif est de prouver si les huiles de montagne ont des caractéristiques de typicité par rapport à celles produites en plaine, qui peuvent générer des attributs de «marketing-mix» facilitant ainsi l'obtention de revenus liés à la différenciation. Une attention particulière sera enfin accordée aux appellations d'origine et aux labels oléiculture biologique.

Mots-clés: rentabilité, valeur ajoutée, agriculture de montagne, label de qualité, huile d'olive.

text of low prices on the bulk olive oil international markets, the strong expansion of new irrigated olive-growing areas under intensive and super-intensive cultivation in Spain and throughout the world (Portugal, Argentina, Australia, etc.), constitutes a competitive disadvantage for mountain olive groves.

If we add to this the fact that mills are still selling a high percentage of their oil in bulk, along with the special difficulties concerning generational renewal and the small average size of farms, mountain olive groves will not find it easy to compete with high-productivity groves in the future. Furthermore, these olive groves have strong potential in the production of environmental externalities, particularly in terms of ero-

sion and soil degradation, if vegetation cover is not employed (Fleskens and Graaff, 2008; Guzmán and Navarro, 2008; Nekhay *et al.*, 2009). Therefore, if appropriate policies on public assets are not implemented in the future, a significant part of Jaén's marginal olive groves is at risk of being abandoned.

Nevertheless, the traditional mountain groves of Jaén have some potentialities which can counteract the physical and structural disadvantages that affect their profitability:

i) They are agricultural systems which frequently have a high cultural, landscape and environmental value, as well as strong potential for developing multifunctional activities. Experts advise on the need to promote a multifunctional approach in mountain olive groves, by means of local development strategies that respect the environment and enhance the value not only of the oil but also of the local olive landscapes and olive oil heritage (Sanz-Cañada *et al.*, 2012).

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ii) In Jaén's mountain olive grove regions there is a significant spatial concentration of a wide-spread network of olive farms, oil mills and marketing firms, inputs suppliers, concentric diversification businesses, companies using olive by-products and local institutions related to olive oil and rural development – PDO Regulatory Boards, Associations for Integrated Pest Management (ATRIAs), Integrated Production Associations (APIs), networks and associations of organic farmers, rural development groups, etc. –. These local olive oil systems not only produce commercial goods and add value to local chains, but are also characterised by their production of public goods.

The aim of this study is to estimate and analyze the profitability of the value chain of Jaén's mountain oils and their spatial differentiation, segmenting the analysis by types of cultivation systems of olive groves and by olive oil mountain – with or without PDO – and lowland areas. The segmentation also takes into account the production phases of the local chains, as well as the bulk and bottled oil chains, considering especially organic and PDO labelled oils. This disaggregation constitutes a contribution of this study and permits to obtain relevant information for implementing territorially oriented public policies aimed at the production of quality food. Therefore, the first objective of this research is to examine the competitive disadvantages, in terms of differentiation-related income, costs and profitability of local mountain olive groves systems, compared with those in the lowlands (Section 3.1). A second objective is to verify if Jaén's mountain olive oils present typicity characteristics, compared to lowland oils, which could generate specific marketing-mix characteristics aimed at obtaining differentiation-related incomes by means of PDO labels, which will counteract the productivity disadvantages of the agents and firms of mountain oil (Section 3.2). We discuss the results and conclude in Section 4 pointing out the relevance of the analysis for implementing territorially-oriented policies.

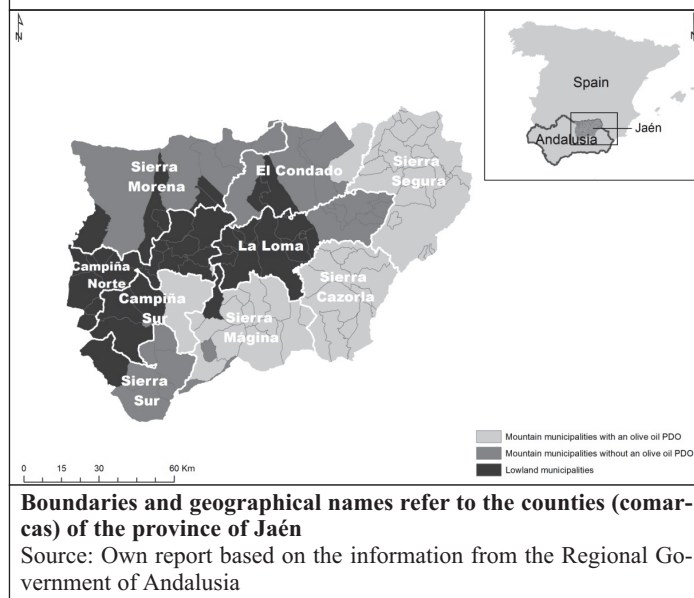
2. Materials and Methods

2.1. Study area: Jaén Mountain Olive Oil Local Systems

The olive groves of the province of Jaén, which occupy more than 570,000 hectares, extend throughout the province, as a monoculture in most areas. For the demarcation of the mountain municipalities of Jaén, we have adopted the classification of municipalities used by the Andalusian Regional Government in 2011, aimed at providing CAP subsidies to mountain areas which used the criteria of altitude and slope¹. The breakdown of the geographical

analysis into olive oil regions is as follows: i) *mountain municipalities with an olive oil PDO* – *Sierra Mágina, Sierra de Cazorla and Sierra de Segura*, occupying 29.7% of Jaén's olive cultivation area; ii) *mountain municipalities without an olive oil PDO* – the *comarcas* of *Sierra Sur* and a good part of *Sierra Morena* and *El Condado*, 25.8%; iii) *Lowland municipalities* – the rest of the province, 44.5% (Map 1).

Map 1 - Jaén olive oil geographical units: Mountain (PDO and non-PDO) and lowland municipalities.



In the Jaén mountain areas, traditional **mountain olive groves** – frequently, one-hundred-year-old (or nearly) trees – are widely represented, as a result of former processes of ploughing for the expansion of the olive cultivation areas in different historical periods. Extensive olive orchards predominate, which are characterised by a low use of external inputs and by the physical conditions of high and medium-high slopes on which they grow. These types of low-yield groves have three trunks per tree and are generally cultivated in dry-farming. As a consequence of the slopes, together with the three-trunk-tree plantations, mechanization of the harvest is not feasible and, consequently, cultivation costs are significantly higher than in the lowlands. Ecological limits and scarce profitability prevent the intensification of production by the replanting of trees, as is taking place in the lowlands. Two big Natural Parks are located in the area covered by the three Jaén olive oil PDOs: *Cazorla, Segura y Las Villas* (209.920 ha) and *Sierra Mágina* (19.961 ha); a significant area of their olive groves is located within or in the vicinity of the Natural Parks.

Olive growing in Jaén is mostly a part-time activity which is not necessarily professionalised. The average size of an olive farm is 3.67 ha in the mountain areas, significantly smaller than in the lowlands (4.4 ha), even more so compared with the Spanish national average (5.5 ha)² and quite far from the optimum size for conducting full-time agricul-

¹ Directive 86/466/CEE of the Council of 14 July 1986. The criteria for being qualified as a mountain municipality refer, among others, to having a significant presence of areas with 15-20% of slope or 1000 m high.

² The source of the data related to the Jaén olive growing and its spatial distribution, mentioned in this Section, is as follows: own estimation based on the data of the Agriculture and Fisheries Depart-

tural activities. Families have generally several sources of income, which include work at local level in other sectors, emigrations of a temporary nature to nearby areas and access to different types of subsidies. Systems involving family labour and reduced costs with low levels of inputs are thus employed, despite generating lower yields.

In Jaén, **olive oil local production systems** are made up mainly of a wide group of olive growers who are organised into agro-industrial milling cooperatives, which produce 77% of the oil of the province³, and by a minority group of small private olive oil mills, which frequently belong to owners of big farms. The localization pattern of the mills is quite diffuse since they are located in the neighbourhood of the farms in areas of monoculture⁴.

Olive oil, although a product with high possibilities of territorial differentiation, still enjoys in Spain a scant general reputation as territorially-differentiated oil for most consumers⁵. Likewise, we point out the very high concentration share held in the Spanish olive oil market in 2013 (excluding self-consumption) by the retailer brands (64.7%) or by the private labels belonging to the first bottling groups (Deóleo, 15.2%; Acesur, 6%; Ybarra 4.9%)⁶, as compared with more than 1,700 mills which wish to sell their products to the former companies in a context of great contractual imbalance. As a result, mills sell the oil in Spain mainly in bulk, through specialised brokers, to Italian or Spanish big bottling-refining companies that label their oil

under their private brand or under a retailer label: their commercial margins are usually very narrow and the value added locally is thus scarce.

The percentage of extra virgin oil produced is much lower on average in Jaén (16.5%) than in Spain (37.5%). The fall in the percentage of extra virgin oil has occurred particularly in Jaén over the past few years⁷. In low-price situations, as since 2007, the bulk price differences between extra virgin and lampante oil are small, which has not particularly encouraged quality bulk production in Jaén because of the higher harvesting costs of the sloped olive groves that characterize the province. Only in the Jaén **PDO areas**, percentages of extra virgin olive oil (27%) remain nearer national averages⁸. With the aim of counteracting the low or negative profitability of bulk oil, several second-degree marketing companies, which comprise a large number of cooperatives and some private mills, are beginning to consolidate in Jaén, although their coverage is still mainly local. These associative entities aim to concentrate the bulk oil offered in order to improve their negotiating power with the retailers and to save logistic costs, but some of them also sell bottled-branded olive oil⁹.

In Jaén, our own estimations¹⁰ show that differential-quality oils, bottled with a mill's private label, may be around only 1.8% of the total produced in Jaén (10,500 tm). Nonetheless, half of this differential-quality oil is produced in PDO mountain areas, whereas they only account for a quarter of the olive grove surface of the province. The increase in the production of quality-oil, promoted by the Regulatory Boards in the past few years in the Jaén PDOs, has thus led to a situation in which more than 80% of the potentially certifiable extra virgin olive oil continues to be sold mainly in bulk.

In the Jaén PDOs, the small private-owned mills and the organic producers, together with some cooperatives, are emerging in the promotion of quality oils and in the search for new markets, outside the Large Retailers' channels. In PDO mountain areas, olive oil stakeholders need to counterbalance their production constraints by marketing their oil as a quality-differentiated product based on its *terroir* characteristics¹¹, either in local and proximity channels – where synergies between the sale of oil and other economic activities, such as rural tourism, are obtained – or in the quality-oil external or restoration channels¹².

The notoriety of the organic label on the consumers, above all in foreign European markets, is rewarded with differentiation-related revenues (see section 3.1.3), which are not always obtained through PDO labels. The largest channel for this organic oil is the external market (70%¹³), in segments with little sensitivity to prices and high sensitivity to quality, health and the environment. **Organic olive growing** in Jaén is increasing steadily every year, but only occupied 5,373 ha in 2011 out of a total of more than 570,000 ha of olive groves; even so, Jaén is the third-largest Spanish province, after Córdoba and Sevilla, in terms of organic olive grove surface area. The spatial distribution of

ment, Andalusian Regional Government for 2012. The source for the Spanish average is: Agrarian Census 2009, National Statistics Institute.

³ Source: Spanish Olive Oil Agency (2012).

⁴ The more common local pattern relates to one or two cooperatives per municipality, in addition to several small private mills.

⁵ The short history of certain Spanish olive oil PDOs and the limited investment in promotion activities, particularly at a firm level, are other factors that contribute to the low notoriety of the labels.

⁶ Source: *Alimarket Revista*, January 2014.

⁷ Percentages are the average of the last two marketing years, which show a 36% fall compared with the average for 2006/8. Source: Statistical Yearbook of Agriculture 2012, Government of Spain.

⁸ According to the information obtained from the interviews. See: Sanz-Cañada *et al.* (2013).

⁹ Interóleo is an associative marketing firm exclusively of bulk olive oil, while the second-degree cooperatives *Olivar de Segura*, *Jaencoop* and *Oleocampo* sell mostly bulk oil but bottled branded oil as well. The highest percentage of bottled oil is that of *Olivar de Segura* (30%).

¹⁰ Sanz-Cañada *et al.* (2013).

¹¹ Intensive lowland production adopts a broader range of pricing strategies, because of factors such as their greater productivity and their significantly lower production costs – as a result of the generalisation of mechanised harvesting and the greater size of farms.

¹² Some firms are more oriented to selling their oil in local channels (La Bética, 35%; La Bedmareense, 25%), while others are more devoted to the external markets (La Bética, 30%; Potosí 10, 20%) or to the restoration channel (La Bedmareense, 25%). See: Sanz-Cañada *et al.* (2013).

¹³ Sanz-Cañada *et al.* (2013).

organic olive growing in Jaén shows that 59% of the production of organic olives is located in PDO mountain areas, a percentage quite significantly higher than that related to the non-PDO mountain areas (8%)¹⁴. Organic production has a special weight in PDO *Sierra de Segura*¹⁵.

2.2. Methodology

The methodology of this study includes the use of primary sources, with information obtained from interviews conducted with local experts: i) cost and income-based interviews aimed at growers, mills and marketing companies; ii) in-depth semi-directive interviews on institutional and territorial governance of the local olive oil systems. We have taken into account the results obtained by a number of studies on the estimates of the costs structure and the value chain of olive oil in Spain, Andalusia and Jaén: AEMO (2010 and 2012), CES (2011), García-Brenes (2004), Junta de Andalucía (2008 and 2010), MARM (2010) and Vera *et al.* (2007).

Cost and income-based interviews aim at estimating the value chain. Their objective is to estimate the profitability of farmers, oil mills and marketing firms. The following types of costs related to olive farms are considered: i) costs directly attributable to the olive cultivation (pruning, tillage, removing water shoots from trees, fertilisation, weed control, pest and disease control, harvesting, irrigation, payments to ATRIA, etc.); ii) other farming-related costs, such as depreciation and maintenance of machinery and facilities, rates and taxes, electricity, payment of accounting and management services, etc. In respect of the income of olive farms, taken into consideration was the income from the sale of olives, along with subsidies from the Common Agricultural Policy (CAP) and from the Andalusian Regional Government (one-off payments, agri-environmental schemes, pest treatments, etc.). Costs borne by olive mills and marketing firms include the cost of buying the olives, depreciation and maintenance of machinery and facilities, rates and taxes, cost of PDO labels, wages and salaries, power costs, payment of administrative and management services, etc. The income earned by olive mills and marketing firms comprise the sales of the oil, differentiating between bulk and bottled, subsidies and the sales of by-products and waste.

The purpose of the *interviews on the institutional and territorial governance of local olive production systems* is the analysis of the organisational dynamics of Regulatory Boards, due to the fact that they act as local inter-professional institutions. The interviews also focus on other types of companies that fulfil this role, such as second-degree marketing cooperatives, organic oil cooperatives, etc. Accordingly, special attention has been paid to the study of the

¹⁴ The percentage of the lowlands area is 33%, compared with its weight of around a half of the olive groves surface area of Jaén.

¹⁵ Particularly, in the municipality of Génave, where an associative movement of organic growers set up the *Sierra de Génave* cooperative in 1989 and become one of the pioneers of the organic olive oil production in Spain.

typicity of mountain olive oils, compared to oils from the lowlands. The information to develop Section 3.2, about typicity of mountain olive oil, has been obtained not only from these kinds of interviews with experts but also by the available bibliography. It should be noted that, in international literature, the studies about the different characteristics of mountain and lowland olive oils are not very frequent, and, moreover, the results may vary depending on the variety of olive grove analyzed.

Twenty-six interviews of the first type were conducted, fourteen of the second and nine that combined both types of interviews. The local stakeholders and experts interviewed were of the following types: i) managers and technical staff from the Regulatory Boards of the three PDOs; ii) agronomists working for the ATRIA, APIs and cooperatives; iii) managers, presidents and owners of olive oil mills and marketing firms; iv) researchers and university professors, as well as other agents with a leading role at local level and in the Jaén olive oil industry. The study has given priority to: i) companies that develop clear oil differentiation strategies, particularly in the scope of PDOs; ii) the four main second-degree marketing firms and cooperatives located in the province of Jaén-Olivar de Segura, Jaencoop, Interóleo and Oleocampo. In addition, olive oil prices provided by Interóleo and Poolred have been used as statistical sources on olive prices.

To break the analysis down according to the types of olive cultivation systems, we have used our own classification based on that applied to the reports and databases of the Andalusian Regional Government (Junta de Andalucía, 2008 and 2010), which is shown in Table 1.

Table 1 - *Types of cultivation systems.*

	Slopes	Non-irrigated / Irrigated land	Plant density Trees/ ha	Traditional / renovated olive grove. Potentiality of mechanisation
Sloped olive groves	≥ 20%	Non-irrigated	100-120	Traditional: >25 years old with various trunks. No mechanisation is possible
Non-irrigated low-yielding groves	< 20%	Non-irrigated	100-120	Traditional. Difficult mechanisation
Non-irrigated medium-yielding groves	< 20%	Non-irrigated	130-150	Renovated (1 trunk) and mixed (trad. and renov.) in relatively fertile soils. Possibility of mechanisation
Non-intensive irrigated groves	< 20%	Irrigated	100-120	Traditional and various trunks. Possibility of mechanisation but with difficulty
Intensive irrigated groves	< 20%	Irrigated	>200	Renovated. High possibilities of mechanisation in fertile soils

Source: Own report based on information from the Regional Government of Andalusia

3. Results

3.1. Estimate of the value chain of mountain and lowland olive oil in Jaén

3.1.1. Profitability of mountain and lowland olive groves

Tables 2, 3 and 4 present the estimate of the profitability obtained by farmers from the olive oil production systems in mountain areas (with or without PDO), compared to that

Table 2 - Profitability of olive production in mountain areas with PDO in Jaén.

Profit Cultivation systems	€ per farm			€ per hectare		% surface area
	CAP subsidies included	CAP subsidies not included	% no. of farms	CAP subsidies included	CAP subsidies not included	
Sloped groves	-568	-1.438	51.8	-196	-496	42.6
Non-irrigated low-yielding farms	1,057	-378	25.3	302	-108	25.3
Non-irrigated medium-yielding farms	6,953	2,179	3.5	903	283	7.7
Non-intensive irrigated farms	2,485	15	17.2	654	4	18.7
Intensive irrigated farms	19,809	13,121	2.2	2,251	1,491	5.7
AVERAGE MOUNTAIN AREAS WITH PDO	1,089	-466	100	313	-131	100

Source: Own report based on interviews.

Table 3 - Profitability of olive production in mountain areas without PDO in Jaén.

Profit Cultivation Systems	€ per farm			€ per hectare		% surface area
	CAP subsidies included	CAP subsidies not included	% no. of farms	CAP subsidies included	CAP subsidies not included	
Sloped groves	-567	-1,467	42.6	-189	-489	33.0
Non-irrigated low-yielding farms	1,169	-348	46.0	316	-94	44.0
Non-irrigated medium-yielding farms	6,468	2,128	3.2	924	304	5.7
Non-intensive irrigated farms	5,228	223	7.4	679	29	14.7
Intensive irrigated farms	26,610	17,794	0.8	2,294	1,534	2.6
AVERAGE MOUNTAIN AREAS WITHOUT PDO	1,124	-543	100	290	-140	100

Source: Own report based on interviews.

Table 4 - Profitability of olive production in lowland areas in Jaén.

Profit Cultivation systems	€ per farm			€ per hectare		% surface area
	CAP subsidies included	CAP subsidies not included	% no. of farms	CAP subsidies included	CAP subsidies not included	
Sloped groves	-497	-1,247	13.7	-199	-499	7.8
Non-irrigated low-yielding farms	1,239	-483	62.0	295	-115	59.3
Non-irrigated medium-yielding farms	7,769	2,375	2.7	893	273	5.2
Non-intensive irrigated farms	3,205	-45	20.4	641	-9	22.9
Intensive irrigated farms	36,795	24,255	1.2	2,230	1,470	4.8
AVERAGE LOWLAND AREAS	2,039	-100	100	460	-24	100

Source: Own report based on interviews.

obtained in lowland areas, breaking down the analysis also by type of cultivation systems.

We can see that the “sloped groves” type of cultivation shows, in all olive oil production zones, an average loss or zero profit both per farm and by surface area, including CAP subsidies. This has a special impact in mountain areas with PDO, where “sloped groves” show an average loss of €568 per farm and €196 per ha (Table 2); it also constitutes the main type of cultivation system, with 51.8% of total

¹⁶ The “non-irrigated medium-yielding groves” type obtains better economic results than “non-intensive irrigated farms”, as they have an average cost per olive of €0.32 kg, which is lower compared to the 0.38 €/kg for “non-intensive irrigated farms”.

farms and 42.6% of the surface area. A similar situation can be observed in mountain zones without PDO, whose “sloped groves” type shows losses of €567 per farm and €189 per ha (Table 3), affecting 42.6% of farms and 33% of the surface area. Even in lowland areas, the respective losses for this type are €497 per farm and €199 per ha, although in this case the specific weight of the “sloped groves” type is obviously quite lower with regard to mountain areas – 13.7% and 7.8% – (Table 4).

In relation to “non-irrigated low-yielding” and “non-intensive irrigated” cultivation types, profitability is negative or close to zero in the three olive oil production areas when we examine profits without subsidies, except in the case of the “non-intensive irrigated” type in mountain areas without PDO; nevertheless, the profit turns out to be moderately positive when we take subsidies into account. Furthermore, only “non-irrigated medium-yielding” and, above all, “intensive irrigated” cultivation systems show positive profitability figures without subsidies in the three olive oil production areas, but these types comprise only 13.4% of the surface area in mountain areas with PDO, 8.3% in mountain areas without PDO and 10% in lowland areas¹⁶.

Consequently, the economic and social repercussions of the absence of public policies would be quite negative in terms of the subsistence of olive production farms, not only in the mountain zones but also in lowland areas. A great part of the surface area of the three zones would have negative or almost zero private profitability, but an even more relevant fact is that it would affect a very high proportion of farms – between 77.1% and 96.1% in the various olive oil production areas¹⁶.

Also, the differences between profits per farm in the different types of cultivation systems are very large in each of the three areas. In particular, in mountain areas with PDO, the average losses of “sloped groves” type are €568, in contrast with “intensive irrigated farms” that achieve a profit of €19,809 per farm: these differences are greater in mountain areas without PDO and even more so in lowland areas. Income per ha in “intensive irrigated farms” are, on average for the whole province of Jaén, almost five times that of “sloped groves”, while the cost relation of both types is two to one.

Finally, the mean profitability – weighted mean of the various types of cultivation systems – of the olive groves in each of the three olive oil production areas is compared, taking into account subsidies (Tables 2, 3 and 4). Lowland

areas obtain clearly higher average profits than mountain areas: €460/ha in lowlands compared to €313/ha in areas with PDO and €290/ha in areas without PDO. Differences increase when the average profit by farm is taken into consideration: €2,039/ha in lowlands, compared to €1,089/ha and €1,124/ha in the mountain areas with and without PDO respectively.

In addition, we have estimated, based on interviews, the structure of costs, income and profitability for **conventional and organic systems** of the cooperative *Sierra de Génave*, a representative case of traditional mountain groves in Jaén. The average profitability obtained by organic producers is €290/ha, comfortably outweighing the loss by conventional olive producers (-€233/ha). Total average income per hectare from organic mountain olive production is 63% higher than that from the conventional orchards, being more or less equal to their average total costs per hectare. The significant decline in the profitability of conventional olive farming and the increasing differential of prices between organic and conventional oil over recent years is favouring the increase in the surface area of organic olive production in the mountains of Jaén.

3.1.2. Profitability of bulk oil: oil mills and second-degree marketing firms

Firstly, the social purpose of cooperatives justifies the existence of a zero business profit, and consequently oil mills fix the price per kilogram of olives delivered, such that income and costs are balanced. Estimating the structure of costs of a Jaén oil **mill cooperative**, which corresponds to the sector average in the province – with a production of 1,500 tonnes of oil –, we find that the largest cost is that relating to raw materials –79.5% of total costs. Way behind this are other variable costs such as oil milling costs –10.3% –, bottling costs –7.8% – and fixed costs –1.5%¹⁷. That means that, although economies of scale take place in the area of milling and, to a lesser extent, in bottling, the profitability of olive oil mills and farmers who belong to cooperatives depends a great deal on the selling price of bulk oil.

Secondly, as an indicator of the profitability of the local chain of bulk olive oil, we have assessed the profitability of Jaén's **second-degree marketing companies**. Table 5 compares the average selling price of the bulk olive oil of *Olivar de Segura*, *Jaencoop* and *Interóleo*, weighted according to the relative share of the different qualities (extra virgin, virgin and lampante), with the *Poolred* price index and with the prices of *Oleoestepa*, a second-degree cooperative of the province of Sevilla, positioned in the medium-high and high quality bulk olive oil market segment¹⁸. In the last marketing years, *Olivar de Segura*, *Jaencoop* and *Interóleo*

Table 5 - Selling prices of bulk olive oil in second-degree marketing firms: *Olivar de Segura*, *Jaencoop* and *Interóleo*.

Mean weighted prices by volume of marketed olive oil: €/kg of olive oil.

Marketing year	<i>Olivar de Segura</i>	<i>Jaencoop</i>	<i>Interóleo</i>	<i>Poolred</i>	<i>Oleoestepa</i>
2009	2.05	-	-	2.00	2.04
2010	1.80	-	1.82	1.87	2.17
2011	1.77	1.75	1.76	1.80	2.16

Source: *Olivar de Segura*, *Jaencoop*, *Interóleo*, *Oleoestepa* and *Poolred* System (Foundation for the Promotion and Development of Olive Groves and Olive Oil).

obtained similar values, slightly lower than the *Poolred* index, while *Oleoestepa*, thanks to its positioning in a medium-high quality segment, achieved a differentiation-related income, compared with *Poolred*, close to €360/t. Therefore, we can state that these associative models for marketing bulk oil have not yet been able to change the unfavorable competitive situation which most olive growers in Jaén are enduring. Consequently, an effort is needed to pool greater volumes of extra virgin olive oil, which will probably improve the profitability of the Jaén model for marketing bulk olive oil.

3.1.3. Profitability of local chains for bottled olive oil

Private oil mills and a small group of cooperatives have in recent years been selling a significant part of their oil bottled and labelled, although not a majority. Within this framework, we can basically distinguish between two types of commercial strategies. One has the objective of maximizing the volume of sales at low prices, focusing on the increase in sales of bottled oils, to the detriment of bulk oil, with fairly reduced margins. The second strategy is focused on the sale of differential-quality oil with a link to a particular territory, within the scope of PDOs from Jaén, in a core of companies which are trying to allocate their olive oil to diverse market niches and segments: organic oil companies, private enterprises focusing on the production of *terroir* olive oils, private marketing companies that work with different local quality oil brands, as well as some first-degree cooperatives that are beginning to be involved in the commercial processes of differential-quality oil.

Table 6 presents the income obtained in the phases of associative local marketing and of large retailers by a second-degree marketing firm of a significant size, which produces medium/medium-high quality conventional extra virgin olive oil with a volume strategy, as well as differential-quality organic olive oil. The retailers receive €3.33/l for extra virgin oil and have total costs of €3.22/l, resulting in a net margin of €0.11/l. On the other hand, the second-degree marketing firm receives €3.22/l, but has total costs of €3.80/l, which means a negative net margin of €0.58/l. Conversely, big retailers fix a significantly higher price for organic oil that determines positive profitability for the two stages: €0.70/l for retailers and €0.19/l for the marketing firm.

¹⁷ Moreover, we have tested that the range of variability of the costs structure of the Jaén olive oil mills is not high.

¹⁸ Data relating to *Oleoestepa* comes from García-Brenes and Sanz-Cañada (2012).

Table 6 - Distribution of income and costs of the value chain. Second-degree marketing firm.

€/l: litre of extra virgin oil in pet. 2012

Phase	Extra Virgin Conventional			Extra Virgin Organic		
	Price*	Cost	Net margin	Price*	Cost	Net margin
Large retailers	3.33	3.22	0.11	4.81	4.11	0.70
Second-degree marketing firm —belonging to olive farmers—	3.22	3.80	-0.58	4.11	3.92	0.19

(* We have deducted 10% VAT from the retail price.
Source: Own report based on information from interviews

Table 7 - Distribution of income and costs in the value chain for oil with a PDO label.

€/0.5 l in a glass bottle. 2012.

Phase	Price*	Cost	Net margin
Large retailers	2.88	2.35	0.53
Mill and marketing firms	2.35	2.20	0.15

(* We have deducted 10% VAT from the retail price.
Source: Own report based on information from interviews.

Table 8 - Average prices in the value chain of extra virgin olive oil.

€/l. 2012.

	Olive growers (***)	Olive oil mills		Local marketing companies		Large retailing firms (***)	
		Price received	Gross Margin (****)	Price received	Gross Margin	Price received	Gross Margin
Conventional Oil / pet (*)	1.41	1.65	0.24	3.22	1.33	3.33	0.11
PDO oil / glass (**)	1.68	1.92	0.24	4.70	2.54	5.76	1.06
Organic oil / pet (*)	2.05	2.29	0.24	4.11	1.57	4.81	0.70

Source: Own report based on interviews and <http://www.elcorteingles.es/>
(****)

(*) One litre format in pet from Olivar de Segura. (**) 0.5 l. glass bottle from “La Bética”, with “Sierra de Cazorla” PDO label.

(***) The prices at the phase of the olive growers are expressed in €/kg and the conversion factor is 0.916 kg/l of oil.

(****) For all categories, average costs of €0.24 /l have been considered, including costs of milling, overhead costs and the financial costs of an oil mill.

Therefore, for commercial strategies of volume and average quality extra virgin olive oil, large retailers impose a considerable downward pressure on prices, using the sale of olive oil as a “hook” product to attract consumers to their establishment. These contractual imbalances determine that, despite the local integration of olive growing, industrial and marketing phases in a single company, these efforts are not sufficient to obtain significant income at local level. However, this does not occur with organic olive oil, where differentiation-related income associated with the organic label is obtained – €0,19/l –, though large retailers’ phase is that which registers higher unitary prices – €0,70/l. To this it should be added that the organic oil from local marketing firms obtains a clearly higher differentiation-related in-

come in the case of the export channels, which are, moreover, the majority. In the estimate carried out for the organic olive oil of Sierra de Segura (average of bulk and bottled), a profitability of €290/ha is obtained, compared to a negative profitability of €233/ha for the production of conventional oil.

In Table 7 we estimate the differentiation-related income obtained along the value chain for a PDO labelled oil produced by a small/medium-sized olive oil mill – which includes marketing activities – increasingly dedicated to the production of differential-quality olive oil. Large retailers achieve a net margin of €0.53/0.5 l, while local mills obtain a profitability of €0.15/0.5 l. Thus, the productive and commercial strategies implemented by companies devoted to differential-quality in mountain oil production systems generate significant differentiation-related income, although not very high, linked to the PDO label. This model should therefore be extended to a broader range of local companies and, consequently, reduce the high percentages still dedicated to the marketing of bulk oil.

In Table 8 we present a summary of a number of results obtained in respect of the distribution of the bottled extra virgin oil value chain, through the estimate of the average prices received throughout the chain of three products – conventional extra virgin olive oil, PDO labelled oil and organic extra virgin oil – for four phases of the chain: olive growers, oil mills, second-degree marketing companies and big retailing firms. Although there are a great variety of commercial strategies, we have taken into consideration certain significant cases of bottled oils for the estimate. In the case of conventional and organic oil, we have considered the format of a litre in pet, while for oil with PDO, a half litre glass bottle, which is quite common for top range oils.

Large retailers obtain fairly low gross margins in the case of conventional oil in pet (€0.11/l) and achieve low profitability in these types of “volume strategies” aimed at a high stock rotation of the food products and references. However, the gross margin is quite a lot higher in the case of organic oil in pet (€0.70/l) and PDO oil in glass (€1.06/l). It is necessary to bear in mind that the half litre glass bottle significantly increases the unit costs per litre of oil, but in turn generates a higher price premium in the different commercial phases of the chain. Likewise, it is worth pointing out that organic oil in glass combine the influence of both types of attributes – organic and top quality-range – in differentiation-related income.

The prices received by local marketing firms are indicators of the value added locally, as they are supplied almost exclusively with local olives. We have allocated average transformation costs in the oil mills of €0.24/l for the three products. For PDO and organic oil, the local phases of the chain – farmers, mills and marketing firms – generate values (€4.70 and €4.11/l respectively) quite a lot higher than in the case of conventional extra virgin oil (€3.22/l). Olive growers re-

ceive €2.05/l for each litre of organic oil, which clearly exceeds the price obtained for PDO oil (€1.68/l), and is well above the price received from conventional oil (€1.41/l).

3.2. Typicity of Jaén mountain olive oil

The study has examined the possible variation of the chemical composition of the oils based on altitude and climate. In particular, the research endeavours to ascertain whether, for the same variety of olives, significant chemical differences exist between lowland and mountain oil, which also materialise at organoleptic level. In the case of Jaén, we refer specifically to the Picual variety in non-irrigated land, which makes up the majority in the province, but we will also examine the typicity granted to the oil produced in certain mountain municipalities of the Cazorla PDO by the presence of a significant proportion of olive groves of the Royal autochthonous variety.

In the case of the **Picual variety**, noteworthy is the article by Ferreiro and Aparicio (1992), who were the first to demonstrate via experiments that the mountain oils have differentiating characteristics from the standpoint of their fatty acid profiles and their composition in polyphenols. The results obtained were that the chemical parameters which achieved the greatest variations with altitude were the sterols and certain triterpenic alcohols and hydrocarbons. Ferreiro and Aparicio also concluded that in order to significantly appreciate the differences between the lowland and mountain oils, it is necessary to compare those produced below 400m and those grown at least above 700m.

The research which had great experimental deployment, both in the field and in the laboratory, during four marketing years, was that performed by the Regulatory Board of the Sierra Mágina PDO in collaboration with the Institute for Agrarian and Fisheries Research and Training (IFAPA) of the Andalusian Government (Consejo Regulador de la

DOP Sierra Mágina, 2005). Its purpose was to determine the optimum harvest time in different area-types of the PDO, but furthermore it offered significant results in relation to the differentiation of lowland and mountain olive oils. Among its main conclusions, it was determined that the lowland area produces fruit with greater average weight, a higher pulp/stone relationship and, consequently a better fat yield than mountain oils. Secondly, the mountain oils stand out for their high oleic acid and polyphenols content, and are the oils with the greatest stability; on the other hand, the lowland oils stand out for having a higher content of fatty palmitic, linoleic and linolenic acids, and for being very rich in tocopherols¹⁹.

These results were corroborated and complemented through interviews with experts, as we show below. Ultraviolet solar radiation is more intense in the mountain areas and the intensity of solar energy is superior, which affects the lipogenesis of the olive grove, which is completed in a much more reduced time period than in the lowlands. On the other hand, the shallow soils of the mountain olive groves limit the possibilities of nutrient intake and storing water. The climate, above an altitude of 800/900 m, is colder and the conditions of the physical environment are harsher than in the lowland olive groves, causing the olives in mountain areas to flower later and to ripen earlier²⁰.

Therefore, due to the lack of empirical research which, on maintaining a series of relatively constant pedoclimatic variables, offers results on the oils produced at different altitudes, there does not seem to be widespread agreement on the variation in the behaviour of certain parameters based on altitude²¹. However, there does appear to be a consensus among the experts and bibliography with respect to the following results:

- i) The differentiating conditions in solar radiation and in the ripening of the fruit influence in making the mountain oils richer in natural antioxidants than those of the lowlands, such as the polyphenols (at least the total quantity of polyphenols) and, in general, the volatile components. Both results determine, on the one hand, a greater stability and a greater resistance to rancidity in the mountain oils. On the other hand, the mountain oils generally have a greater aromatic intensity and a greater fruitiness, which are decisive attributes for the organoleptic quality of the oils.
- ii) With regard to the composition of fatty acids, the proportion of oleic acid is also greater in the mountain oils, while the presence of palmitic and linoleic acids is lesser. This causes the mountain oils to usually obtain more favourable values in the following ratios: saturated/unsaturated and monounsaturated/saturated fatty acids. For this reason, and also due to their greater presence of antioxidants, the mountain oils of the Picual variety are healthier than those of the lowlands, all other conditions being equal.

Some of the interviews offered a detailed explanation of other healthy characteristics of the mountain oils²². In particular, mountain olive oils produce a greater quantity of

¹⁹ In the case of other varieties, Mousa and Gerasopoulos (1996) demonstrated for the Mastroide variety that the composition of peroxides was higher in the mountain olive groves, together with the ratio between saturated and unsaturated fatty acids. Tous *et al.* (1997) also investigated the differences in the chemical composition of various cultivars of the Arbequina variety which had different altitudes and climates, although altitude was not the central explicative variable of the differentiation of the oils. A compilation of the results of various studies on the influence of the agrological environment on the characterisation and quality of the oils of different varieties, although altitude is not the main object of the analysis, is discussed in Uceda *et al.* (2008).

²⁰ According to one interviewee: *"In the mountain olive grove on non-irrigated land, especially above an altitude of 800 m, the plant suffers three types of stress: water, heat and light stress"*.

²¹ Some of the chemical and organoleptic parameters for which we have listened to opinions that do not always coincide are the fat yield and the tang and bitterness of the oils.

²² In certain interviews, a high degree of information was obtained, greater than in the available bibliography. Especially noteworthy were the interviews held with Juan Torres, owner of the "Agropecuaria del Puerto" olive oil mill, and with Gabriel Beltrán, researcher at the IFAPA centre "Venta del Llano".

pigments which give the oil colouring, such as the anthocyanins and the xanthophylls. Since the mountain olives ripen more quickly and on a less gradual basis than in the lowlands, this causes them to have a greater quantity of pigments which give their intense green tonality. In the lowlands, ripening takes longer, as a result of the temperature and solar radiation conditions, and the fruit goes through many more intermediate states. But furthermore, the mountain oils produce a greater quantity of phytoalexins, which are antimicrobial compounds segregated by the plants themselves: they are very interesting components for the pharmaceutical industry as they are natural colourings which filter the excess solar radiation, to avoid that the chlorophyll becomes inhibited and reduces the photosynthesis.

Likewise, it is considered that the mountain oils are more fluid, more liquid and less viscous on the palate. This fact is explained because they have a lower proportion of palmitic acid and of other saturated fatty acids, which are responsible for the viscosity of the oil²³.

Lastly, the differentiation factor of the Cazorla PDO is precisely the fact that 6% of its olive trees are of the **Royal variety**, as opposed to the rest of the olive oils of the Jaén province, which are Picual monovarietal. The Royal variety is endemic to the highest and most steeply sloped mountain areas of the Cazorla PDO²⁴. No plots exist in the mountains which are exclusively cultivated with the Royal variety, but they are rather heterogeneously disseminated in the plots between trees of the Picual variety. The characteristics of the variety have determined that they historically spread only towards the mountain areas. On the other hand, in the hilly and lowland areas it has been more advantageous to plant the Picual variety, both due to questions of yield and to undesirable agronomical characteristics of the Royal variety: the wood is very brittle and the resistance to fruit drop is very high, which seriously hinders mechanisation.

Consequently, the differentiating element of the Cazorla PDO does not only lie in the differentiating characteristics of the Picual mountain oil, rather that it makes room for the Royal variety, whose oils have physicochemical and organoleptic characteristics quite different from those of the Picual variety. Nowadays, the Royal variety is beginning to be planted again in the mountain, because it has the great advantage of giving typicity to many oils of the Cazorla PDO. Moreover, another important reason is that the Royal oil is, from the standpoint of “coupages”, complementary to the Picual: it is smoother oil, with less tang and bitterness.

²³ According to one interviewee: “It is a type of physiological adaptation of the mountain olive groves since at not very low temperatures, the membranes do not admit the saturated fatty acids well, because they solidify or are not very fluid. Therefore, they adapt by changing their composition and increasing the unsaturated fatty acids.”

²⁴ It is situated around a primitive area in the municipality of La Iruela, where it constitutes nowadays 20% of the olive trees, and extends to the municipalities of Cazorla and Quesada.

4. Discussion and Conclusions

The results of the study show that olive production in Jaén faces important profitability problems in an international economic context of low olive oil prices, which has been particularly intense in the Spanish olive oil sector since 2007. The analysis by types of cultivation systems of the profitability of the olive oil farms in Jaén give some irrefutable results: only the “non-irrigated, medium-yielding” and, mainly, “intensive irrigated” types obtain positive private profitability values in Jaén, but they only include percentages which vary between 8% and 13% of the cultivation areas of the various olive oil production zones.

Although low profitability problems affect all the olive oil production areas of Jaén, it is especially acute in the mountain zones. The “sloped groves” cultivation type has, in all Jaén’s olive oil production areas, an average profitability which is negative or zero, both in terms of private profitability and also if we include the CAP subsidies in the estimate. This has a particular impact in the Jaén mountain areas, where “sloped groves” cultivation type is clearly in the majority: it has a greater impact in areas with PDO (43% of the production surface area) than in areas without PDO (33%) – compared to 7.8% in lowland areas. Many mountain olive farms are maintained thanks to the support of the family labour, CAP subsidies and income from activities other than olive production. The limiting characteristics of the physical environment mean that there are high costs and low yields by unit of surface area and, in addition, any production restructuring of their farms turns out to be very difficult. Due to the different types of cultivation systems and to the smaller average size of the farms, there are important differences between the average profitability values of mountain farms compared to those in the lowlands, which can be double when the results are expressed by profit per farm: €2,039 in lowland areas compared to €1,089 in mountain areas with PDO. Consequently, mountain olive groves run the risk of becoming abandoned, which would have negative consequences for the territorial development and agricultural landscapes.

In order to compensate the situation of low or negative profitability of olive oils from Jaén, which are commercialized mainly in bulk, two types of initiatives have been recently implemented, but their scale is still insufficient to reverse the low average profitability of mountain olive oil systems. Firstly, second-degree marketing entities, at different geographical levels in Jaén, have been promoted, but they still have not acquired sufficient size to significantly increase the low prices of bulk olive oil in Spain.

Secondly, the low percentage out of the total of protected oil marketed with a label indicates the as yet poor recognition of Jaén’s PDOs as collective brands. As a result, the implementation of PDO labels has not yet contributed sufficiently, on a macro-territorial scale, to counteract the production disadvantages of the mountain olive oil systems. However, a specific feature of these PDOs is that there is a

core of companies which are implementing emerging strategies for the marketing of differential-quality bottled oil with a territorial link, oriented towards diverse market niches and segments: organic oil companies, small private mills focusing on high quality “payment oils”, private marketing companies that work with different local quality oil brands, as well as some cooperatives that are beginning to become involved in marketing activities of differential-quality oil. These kinds of companies have already started to obtain significant differentiation-related incomes but their number and scope is yet limited. Nevertheless, their activity is extremely important to boost the creation of an innovative environment for the marketing of differential-quality oil, which needs to generate a positive demonstration effect on other local companies. Moreover, the contribution of the PDOs to the development of inter-professional organizations at local level and their function of collective management of services, justify the importance of their existence. One of the main achievements of the implementation of PDOs is that, around the Regulatory Boards, the collective action at a local level has a particular impact on the characterisation of the oils, the dissemination of innovation and knowledge, the development of human resource training activities, the encouragement of joint promotional activities and even on the collective marketing of olive oil (Sanz-Cañada and Macías-Vázquez, 2005).

We have also demonstrated that organic production becomes a solid alternative for mountain olive groves, as it neutralises both productivity and cost disadvantages of olive production in the mountain, generating profitability significantly higher than conventional olive production. This differential profitability derives not only from a greater proportion of bottled oil, which brings in high prices in markets abroad, but also from a more acceptable remuneration from bulk oils compared with conventional oil. Also, cultivation systems which use low levels of inputs predominate in mountain zones, meaning there is a relatively easy transition to ecological standards. In fact, almost 60% of the production of organic oil is located in Jaén in mountain areas with PDO. In addition, from an environmental viewpoint, the main problem with Jaén’s mountain olive production is the high level of erosion and degradation of soil, particularly critical on steep slopes, which can be countered by maintaining the vegetation cover. It would also be advisable to avoid the disappearance of hedges, boundaries and small masses of autochthonous vegetation, with the aim of conserving the biodiversity of mountain olive production landscapes. Organic olive production is a good means of combating these kinds of environmental externalities.

Furthermore, the article contributes to demonstrate that differentiating conditions in solar radiation and in the maturing of the fruit mean that mountain oils obtained from the Picual variety are richer than those from the lowlands in natural antioxidants and have a composition with a larger proportion of monounsaturated fatty acids, among other as-

pects. Accordingly, mountain olives are on average healthier, have a greater stability and resistance to rancidity, as well as a greater aromatic intensity and fruitiness, than those from the lowlands. The interviews have also shown that local stakeholders agree on the fact that there is great potential for commercial differentiation for Jaén mountain oils, based on their particular physical-chemical and organoleptic characteristics by comparison with lowland oils. However, marketing mix strategies concerning mountain oils, based on “health” attributes, together with other attributes like “sensorial quality” or “respect for the environment”, have neither been implemented by the firms nor by the Regulatory Boards of the PDOs.

With respect to the CAP horizon 2020, it is necessary to pay special attention to the implementation of multifunctional public policies to mountain olive groves, with a view to avoiding their abandonment. It is thus necessary to reward mountain oil production systems as producers of public goods. In this respect, Jaén’s mountain olive groves have a relatively high cultural, landscape and environmental value. Consequently, public policies need to reflect the value not only of the oil but also of the landscapes, the environment and the local olive oil heritage. Organic olive growing, designations of origin, joint local marketing and strategies for enhancing natural and cultural olive oil heritage may in the near future generate new territorial development opportunities for mountain olive oil production.

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