# Distribution strategies in the value chain of Spanish virgin olive oils

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***Abstract***

*In Spain, the world's leading olive oil producing country, the existing literature points to a malfunctioning of the value chain, since it hardly generates any profits and some links often incur losses. The aim of this research paper is to analyze the value chain of virgin olive oils, establishing the relationship between the prices of virgin olive oils at origin and the retail prices paid by the end consumer. The methodology used is the analysis of the value chain using quantitative research through descriptive statistics and the process of quantitative data collection under observation together with other statistical methods. The data on retail prices have been obtained from the published information of the commercial operations of the retailers themselves, while the data on prices at origin come from the price statistics elaborated by national (Spain) and international (European Commission) organizations. The conclusions point out that the retail price of virgin olive oils by the distributors does not reflect the real production cost of the product, as it is more a concept of customer attraction strategy on the part of the distributors.*

***Keywords****: Virgin olive oils, Value chain, Costs & Margins, Retail prices, Agri-food chain.*

## 1. Introduction

In Spain, as a leader in olive oil production, a recurring issue is the study of the costs of olive growing and olive oil production, due to the importance of the sector as a socioeconomic driver. In this regard, the Spanish Ministry of Agriculture, Fisheries and Food of Spain (MAPA, 2023a) describes the olive oil sub-sector as a fundamental pillar of the Spanish agri-food system. Moreover, its world leadership is justified by Spanish production, which, according to the International Olive Council (COI, 2024), represents 70% of European Union (EU) production and 45% of world production.

As for the studies that address the value chain, most of them analyze the production costs of olives on the one hand and olive oil on the other (Diputación Provincial de Jaén, 2007; Consejería de Agricultura, Pesca y Desarrollo Rural, 2015) and, although from the beginning, most of them have focused on the first link in the chain, in recent years, published studies have focused

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on all links in the chain (Observatorio de la Cadena Alimentaria, 2021a, 2021b and 2023).

The theoretical basis for determining the retail price of a product is established on the basis of the production costs and the margins of each of the participants in the value chain. In the case of virgin olive oils this situation is not the case due to factors intrinsic to the subsector itself: a) the concentration of demanders; b) the atomization of supply; c) the introduction of the Common Agricultural Policy (CAP) concept; d) the concept of a basic product in the shopping cart with no capacity for differentiation and e) the specific characteristics of a perishable product (Gómez-Limón and Parras, 2017).

Recently, the Ministry of Agriculture, Fisheries and Food of Spain has analyzed the costs of the different links of the value chain in three consecutive campaigns (2018/2019, 2019/2020 and 2020/2021) (Observatorio de la Cadena Alimentaria, 2021a, 2021b and 2023). In the final report there is a comparison of the costs of these three campaigns where it is shown that the agricultural sector is the weakest link, accumulating losses or meager profits when there are any. However, losses have never been found in the packing sector and, in the last campaign analyzed, distribution appears with a negative average margin (Observatorio de la Cadena Alimentaria, 2023). These studies suggest that the prices of virgin olive oils paid by the end consumer do not obey the standard construction of costs and margins that would have to be added by each operator.

Therefore, the study question is whether there is a standard construction of the price of virgin olive oils along the different links of the chain or whether the retail price paid by end consumers is due to other commercial strategies of the operators in the chain.

In order to answer the question, the study objective will focus on analyzing whether the difference in the comparison of retail prices with olive mills' prices at origin is a constant over time and, in any case, sufficient to include packers' and distributors' costs and margins. Otherwise, there must be other factors involved in the strategy of price construction.

The relevance of this study lies mainly in the methodology that it actually applies. In order to analyze the value chain and in the lack of studies on historical series of retail prices of a kilogram of virgin or extra virgin olive oil packaged in large self-service grocery stores: Supermarkets and Hypermarkets (LSSGS), it has been necessary to develop the following paper, which serves as the basis for the subsequent analysis.

From 2016 to 2022, the retail price (RP) of virgin olive oils were taken every twenty-five days from the commercial publications issued by the main Spanish retailers or distributors ('Alcampo', 'Aldi', 'Carrefour', 'Hipercor', 'Lidl', and 'Makro'). An extensive database has been compiled with them, differentiating between Polyethylene Terephthalate (PET) or glass, packaging capacity, organic or conventional and private label or brand name. All this has given us the opportunity to construct real retail prices throughout this period, which have been homogenized at prices per kilogram in order to be able to compare them with the prices at origin (OP) of the official statistics. The previous studies of the value chain have been carried out through surveys on costs and margins, but not on retail prices.

The sequence of the study is developed as follows. After this introduction, where the research area has been delimited, the need for the study justified and the objectives and methodology established, the following section is devoted to the theoretical review. While the third section focuses on developing the research method used, the fourth section analyzes the results obtained. The conclusions point to the fact that the selling price of virgin olive oils does not reflect the real production cost of the product, but rather responds more to a concept of customer attraction strategy on the part of the retailer.

## 2. Theoretical Framework

According to Porter (1985 and 1990), competitiveness is based on greater economic efficiency or greater differentiation in the execution of these activities within the value chain. The main utility of the value chain lies in improving competitiveness and reducing costs, thus increasing value creation (Robben and Quatrebarbes, 2018).

Normann and Ramírez (1993) argue that the analysis should not focus on the fixed activi-

ties of a value chain, but on the value creation system as a whole, where mutual value arises from cooperative interactions. Along these lines, Miller and Jones (2010) pointed out that a chain is only as strong as its weakest link.

For value chains to be sustainable, several conditions apply: a chain needs to generate sufficient value for each link; consumer requirements must be accurately communicated throughout the chain; and the value that a product represents for the consumer must be disclosed and communicated to the target market (McEachern and Schröder, 2004).

With the advent of the Agricultural Value Chain concept, we move away from a segmented form of linkage system in which many separate links operate in isolation rather than synchronizing with each other (McCullough *et al*., 2008). Fries (2007) postulates that value chain analysis is essential for understanding markets, their relationships, the participation of different actors and the critical constraints that limit the growth of agricultural production and, consequently, competitiveness.

Value chains work best when their actors cooperate to produce higher quality products and generate more income for all links (Norton, 2014). In agriculture, chains can be considered as a set of processes and flows from 'farm/field to fork' (Miller and Da Silva, 2007). Conducting a value chain analysis requires a thorough assessment of the changes between actors in a chain, what holds them together, what information is shared and how the relationship between actors is evolving (Sanogo, 2010). In this sense, authors such as Fetoui *et al*. (2024) analyze the olive oil value chain from the relationships between its main operators to bring about effective participation and better performance and resilience in the subsector.

In relation to the sector under study, virgin olive oils, i.e. those corresponding to the virgin and extra virgin categories, are part of the end consumer's shopping cart as a basic product and as part of the Mediterranean culture with a limited capacity for differentiation, which could be categorized as a commodity.

We must make an important mention to the types of price transmission in the vertical value chain in the agricultural, fishing and livestock sectors, which have been extensively studied by Goodwin & Holt (1999), Meyer & Cramon-Taubadel (2004), Arida *et al*. (2023) and Kidane (2025), all of them describing an asymmetry in the transmission, when changes in prices are not transmitted in an equal way. The main factors affecting this transmission process are logistics costs, price reconfiguration, dominant players in the market, demand elasticity and public policies (CAP, tariffs, etc.). And the models that explain it are basically Error Correction Models (ECM), Vector Autoregressive Models (VAR) and Cointegration Models.

We are now focusing on the study of the value chain and the obtaining of prices and margins in the Spanish olive oil sub-sector. The Spanish market is characterized by its asymmetry, with many suppliers (producers) and few demanders (distributors or retailers) (Consejo Económico y Social de la Provincia de Jaén, 2011). According to Parras (2011), the concentration process in the distribution sector, together with the dominance of private labels, has led to an asymmetry in the bargaining power between large-scale distribution and the olive oil agri-food industries. Therefore, it follows a priori that prices are determined by large-scale distribution, which, together with annual production volumes, tend to set the market trend.

The question that arises is whether the price paid by the end consumer for a liter of bottled virgin or extra virgin olive oil has any relationship with the prices at origin or is configured independently (Gutiérrez-Salcedo *et al.*, 2015) thus pointing to a commercial strategy led by the distribution.

All published studies point out that the price paid by the end consumer for a liter of bottled virgin or extra virgin olive oil does not correspond to the real price of costs and margins of the different links involved in the value chain. The Spanish Ministry of Agriculture indicates that it is a paradox that one of the most important subsectors in Spanish agriculture is scarcely profitable, for the grower, and not very transparent in the construction of its prices (MAPA, 2023a).

The research carried out on the olive oil value chain is largely focused on the primary sector,

with the aim of characterizing it and establishing a cost structure and production margins according to the types of olive groves (Consejería de Agricultura y Pesca, 2010; Torres Velasco *et al*., 2011; Consejo Económico y Social de la Provincia de Jaén, 2011; Consejería de Agricultura, Pesca y Desarrollo Rural, 2015; COI, 2015; Penco, 2020). These studies point out that only intensive and super-intensive plantations (they represent a minimum percentage) are profitable, so producers need the Common Agricultural Policy (CAP) subsidies to survive.

Other studies have focused on the entire value chain of the olive oil subsector (Observatorio de la Cadena Alimentaria, 2021a, 2021b and 2023). These were the first to attempt to establish, empirically, the lack of a causal relationship between the retail price of virgin oils and their costs at each stage of production. They conclude that on a regular basis the grower together with the distributors (although the latter for different reasons) obtain negative operating margins in most scenarios. These same studies indicate that packers always obtain meager but positive operating margins (Observatorio de la Cadena Alimentaria, 2021a, 2021b and 2023). Other studies are along the same lines (Diputación Provincial de Jaén, 2007; Consejería de Agricultura y Pesca, 2010; MARM, 2010 and Observatorio de Precios de los Alimentos, 2012).

Focusing on the analysis of the negative operating margins of growers and distributors, the difference between the two lies in the fact that the first ones do not have the capacity to negotiate their sales prices because they are highly atomized and do not have the strength to negotiate, while the second ones do because they are highly concentrated in large purchasing platforms. A different thing is that, even if distributors can configure the selling price of olive oils to generate positive margins, they do not do so in order to attract consumers to their stores and thus be able to sell other products with a higher profit margin, using olive oil as a "lure product" (Consejo Económico y Social de la Provincia de Jaén, 2011; Olimerca, 2017).

García (2006) states that large-scale distribution sets very tight prices for a series of mass-purchased products with little degree of differentiation in order to extend the image of a "cheap" establishment. These products are called "hook products" or "traffic generators". In the most extreme case of this commercial strategy, there are "sales at a loss".

Theoretically, the concept of market asymmetry is explained by the fact that in all of Spain and also in Andalusia, distribution is dominated by only five large groups: 'Mercadona', 'Carrefour', 'Auchan', 'Dia' and 'Eroski'. (Savills Aguirre Newman, 2020), while they produce olive oil in Andalusia and, where appropriate, pack a total of 802 olive mills (Junta de Andalucía, 2022), while in Spain as a whole there are 1,837 for the 2021/2022 campaign (MAPA, 2023c). Clearly, the existing imbalance between suppliers and demanders or purchasing groups, which also hold more than 80% of the market share of the olive oil subsector, can be observed (MAPA, 2022).

Something unusual happens in the olive oil subsector: retail prices are significantly lower than they should be due to the regular increase in the value chain (Observatorio de Precios de los Alimentos, 2010). This is expressed by Gutiérrez Salcedo *et al*. (2015), when they state that the commercial policies of the last links of the extra virgin olive oil chain are focused on maintaining low and stable prices for end consumers, being fundamental for their competitive strategy. Thus, prices seem to be determined more by price variation at destination than by price changes at origin. This would not be a problem if it were not for the fact that setting these prices excessively low would imply dumping (Olimerca, 2016a and 2016b).

What Gutiérrez Salcedo *et al*. (2015) point out about the keeping of stable prices by distribution corresponds to what is expressed by Vavra and Goodwin (2005), who wonder about the speed and extent to which changes in agricultural prices are transmitted to the retail trade and vice versa. They argue that it is important to distinguish between the analysis of the evolution of margins over time and the transmission of prices along the agrifood chain. Conclusions on pass-through drawn from the evolution of trade margins over time that do not incorporate other information, such as the evolution of other input costs, may be erroneous. They limit themselves to analyzing vertical price transmission, adjustment to price shocks along the chain being an import-

ant feature of market functioning. They claim that, due to imperfect price transmission (caused by market power and oligopolistic behavior), a price reduction is only slowly, and possibly not fully, transmitted through the supply chain. In contrast, it is believed that price increases are transmitted more quickly to the end consumer.

The objective of Vavra and Goodwin (2005) is to analyze the mechanisms of asymmetric price transmission and to explore the evidence that empirically measures such transmission. They focus on vertical price transmission and discuss possible types of adjustments to a price shock.

In this way, and following the theory of the value chain and the vertical diagram, the Spanish olive oil subsector is composed of the following links with their corresponding production costs (C) and margins (M):

1. Farmers/Producers: their production costs vary according to the type of cultivation, but based on studies it comprises a range of between 2.07 and 3.56 €/kg (IOC, 2015). In Spain they represent 73.07% of the costs of the value chain (Observatorio de la Cadena Alimentaria. (2021b), data very similar to that expressed by Sarni *et al*. (2024) where he states these are in Tunisia close to 70%. The costs are those of olive growing: fertilization, irrigation, pruning, purchase and application of phytosanitary products, harvesting of the crop, etc.

2. Olive mill: costs related to the reception and classification of olives, milling, filtering and bulk storage.

3. Packers: their costs are directly related to the packaging of different packs and volumes: filling, capping, labeling, packaging, warehouse management and logistics.

4. Distributors: this link is mainly made up of large purchasing centers that monopolize most of the distribution market. The associated costs are logistics, warehouse management and point-of-sale management.

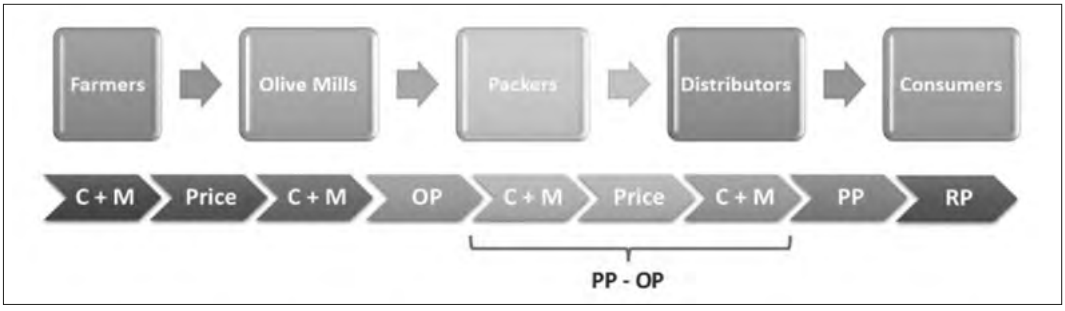
The diagram of the value chain shows the costs and margins for each link in the chain, as well as the transfer prices from one link to another, the object of this study is the prices at origin (OP) and sales prices (PP). The former correspond to the prices that the olive mills set for the product and that the packers pay, while the latter correspond to the prices that the distributors set for the final product, that is, for the virgin olive oils packaged and ready for sale to the end consumers. In the middle is the price that packers set for the packaged product and that distributors pay to subsequently put it on sale in their stores.

In view of the above arguments and following the contributions of the aforementioned authors, our hypothesis is based on the fact that the retail prices of virgin olive oils, as a standard and basic good in the shopping cart in Spain, are determined following the commercial strategy of the distribution and do not follow the standard vertical construction of the value chain, having an asymmetric behavior in the transmission of prices.

## 3. Methodology

The study is based on the systematic analysis over 6 campaigns of a unique compilation of retail prices (RP) of virgin olive oils from all the commercial operations of different distribution companies in Spain. The importance of this study lies in the fact that there is no record of a

Figure 1 - Value chain of virgin olive oils.




*Source: own elaboration.*

similar database, neither for the volume of data in the sample, nor for its qualitative part, nor for its time frame.

From October 2016 to April 2022, every 25 days, the different commercial operations of 6 main Supermarket and Hypermarket Food Chains (LSSGS) established in Spain: 'Alcampo', 'Aldi', 'Carrefour', 'Hipercor', 'Lidl' and 'Makro', were obtained and analyzed through their publications (commercial brochures).

All virgin olive oils were considered in the sample because they account for more than 80% of total olive oil production (MAPA, 2022) and because their production process is basically the same and, therefore, their costs are nearly identical.

All the commercial brochures published within the time frame of the study were used as a database for calculating the product price ex VAT (PP) based on the published retail price (RP). Thus, the following variables were extracted from each of the brochures: name of the distributor, category (Supermarket and Hypermarket Food Chains -LSSGS- and Hard Discount -HD-), year and month of publication, type of packaging (PET or glass), packaging formats (from 250 ml to 5 liters), brands or private label, category of olive oil, the retail price per liter, and whether the price was on sale or not (discount amount).

Once the database was set, the retail price (RP) per liter was established. The tax effect of VAT (10%) was also discounted, obtaining the product price without taxes (ex VAT Price). This last final product price (PP) without taxes, which was in euros per liter, was converted to euros per kilograms of olive oil in order to be able to carry out the subsequent homogeneous analysis with the prices at origin (OP), which are always shown in €/kg olive oil.

The different dates of the commercial brochures of all the distribution companies subject to the study were homogenized, establishing the criterion of incorporating them into the month in which they had been active for the most days. In this way, the product price (PP) could be monthly to be compared later with the prices at origin (OP), whose published statistics are based on months.

After these 6 years of work, a total of 394 price references in their different formats, brands and categories were counted. A true picture of the price evolution of olive oils sold by the large-scale distributors was thus obtained.

Once the PP database in current euros has been prepared, in order to establish an approximation of the margins and costs of large-scale distribution and packers, we focused on obtaining the price at origin database, also in current euros.

The prices at origin (OP) are those selling prices of virgin olive oils from private and cooperative olive mills without packaging, i.e., in bulk. They were obtained from the databases published by the European Commission (Agriculture and Rural Development, 2022) and the Price and Market Observatory of the Regional Government of Andalusia (Observatorio de Precios y Mercados, 2022 and 2023).

In total, 3,757 weekly price data were extracted from the European Commission and 134 monthly price data extracted from the source of the Price and Market Observatory of the Andalusian Regional Government. Both databases were merged on a monthly basis. Subsequently, with the two previous monthly databases, a new common and homogeneous statistical sample was established with average prices by campaigns in €/kg olive oil, using the arithmetic mean criterion. For the present analysis it has not been substantial to work with weighted averages, since the study is based on prices and not on prices linked to production or sales.

Following the criteria established in all the literature published to date, the study established the period of each campaign from October to September of the following year. For this reason, both the product price samples (PP) and the prices at origin (OP) have been worked with aggregated data by season, since the monthly figures of these samples allows such data processing.

This study is based on the use of the methodology for the construction of prices, costs and margins of the value chain. Descriptive statistics was used for all the data analysis, due to its ease of aggregation and visualization of the data of this type of sample, allowing its exposition in an understandable way, in addition to other statistical techniques.

To further deepen the study, a simulation was carried out using data from the Agrifood Chain Observatory (Observatorio de la Cadena Alimentaria, 2021a, 2021b and 2023), comparing

them with our figures to establish whether there is any evidence to support our working hypothesis. In this way, under the assumption that packers allocate 100% of their costs and margins, we have analyzed whether the difference between PPs and OPs for the comparative campaigns allows distribution to incorporate their costs and margins, partially or totally. Therefore, this simulation is a practical advance in the use of the price difference as a tool for investigating the use of the value chain by distribution or packers as a tool for price construction.

## 4. Results

After homogenizing and analyzing the two databases obtained for virgin oils (PP and OP), the following results were obtained:

1. The average difference obtained between the PP and the OP is 0.95 €/kg. This figure should be sufficient for both, packers and distributors to be able to allocate all their costs and obtain profitability.

2. There is an asymmetric price transmission between the OPs and the PPs. Compared to OP increases of 90.31%, the PP only increased by 41.56%.

3. For OP > 3.50 €/kg the differences between PP and OP show a result of 0.63 €/kg (the lowest obtained), while for OP < 1.99 €/kg such price differences show a result of 1.12 €/kg (the highest obtained).

4. The highest campaign in terms of production obtained the highest difference between PP and OP: 1.18 €/kg and the lowest production campaign obtained the second highest price difference with an amount of 1.10 €/kg.

The first result achieved from the analysis indicates that, during the period studied (2016/2017 to 2021/2022 campaigns), no PP was below the OP. The above means that there is a positive difference, greater than zero, which, in theory, allows the links of packers and distributors to allocate costs and profit margins.

The average difference obtain between PP and OP was 0.95 €/kg. This suggests that both, packers and distributors, have on average that amount to cover costs and profit margins. However, further studies would have to quantify that this difference is sufficient to be able to affirm it empirically.

The second result shows that there is a direct, although not proportional, relationship between OP and PP. As both prices increase, the differences also increase, although to a lesser extent. Thus, a 90.31% increase in OP (from 1.96 €/kg to 3.73 €/kg) meant only a 41.56% increase in PP (from 3.08 €/kg to 4.36 €/kg).

Table 1 - Average prices at origin and product prices per campaigns for virgin olive oils.

| *Campaigns* | *OP Average (€/kg)* | *PP Average (€/kg)* | *Average Difference (€/kg)* |
|---|---|---|---|
| 2016/2017 | 3.68 | 4.29 | 0.61 |
| 2017/2018 | 3.11 | 4.06 | 0.95 |
| 2018/2019 | 2.43 | 3.61 | 1.18 |
| 2019/2020 | 2.01 | 3.11 | 1.10 |
| 2020/2021 | 2.85 | 3.74 | 0.89 |
| 2021/2022 | 3.26 | 4.20 | 0.94 |
| *Average* | *2.89* | *3.84* | *0.95* |

*Source: own elaboration.*

Table 2 - Evolution of the average price difference by campaign of virgin olive oils by price range at origin.

| *OP Range (€/kg)* | *OP Average (€/kg)* | *PP Average (€/kg)* | *Average Difference (€/kg)* | *Amplitude Average Difference (%)* |
|---|---|---|---|---|
| OP > 3.50 | 3.73 | 4.36 | 0.63 | 16.89 |
| 3.49 > OP >3.00 | 3.23 | 4.21 | 0.98 | 30.34 |
| 2.99 > OP > 2.50 | 2.66 | 3.74 | 1.08 | 40.60 |
| 2.49 > OP > 2.00 | 2.19 | 3.21 | 1.02 | 46.57 |
| 1.99 > OP | 1.96 | 3.08 | 1.12 | 57.14 |
| *Amplitude ranges (%)* | *90.31* | *41.56* | | |

*Source: own elaboration.*

This result confirms that there is an asymmetric price transmission mechanism. Thus, it could be demonstrated that the distribution uses the PP of virgin olive oils in a strategic way by keeping them stable to attract consumers, resisting to pass on 100% of the increase in OPs.

As a third result, for OP above 3.50 €/kg, the average OP was 3.73 €/kg and the PP was 4.36 €/kg, which implied a difference between both prices of 0.63 €/kg, the lowest obtained. While for OPs below 1.99 €/kg the difference was 1.12 €/kg, the highest obtained. The direct consequence of these results is that in high OP environment, packers and distributors are less able to allocate their costs and margins. However, in OP campaigns below 1.99 €/kg this difference was 1.12 €/kg, so there is a greater capacity to allocate costs and obtain higher profitability.

This third result confirms the asymmetric transmission and points to reinforce the hypothesis of retailer control of PPs as a commercial strategy, keeping them in a price range that they consider optimal to provoke purchase by consumers regardless of their profitability.

The fourth result was obtained by cross-referencing the differences in PP and OP with the olive oil productions of the campaigns under study. Thus, the largest average difference (1.18 €/kg) is seen in the campaign with the highest olive oil production (2018/2019). In that campaign, there was a drop in the OPs more than in the PPs, which were adjusted more smoothly. In this case, it took advantage of the low-price environment to improve profit margins, but we do not know if this higher profit margin was for the packers or distributors. However, harvests with very similar productions (2016/2017 - 2017/2018 - 2020/2021) obtained very different price differences (0.61 €/kg - 0.95 €/kg - 0.89 €/kg), implying a poor relationship between productions and PPs.

This last result shows that the distribution with very unequal production campaigns managed to maintain the price differences above 1.10 €/kg by controlling the PP and putting pressure on the OP. Once again, the asymmetry hypothesis is reinforced, where the weakest links, producers and olive mills (included in the OP) have no buying power vis-à-vis the large purchasing centers (PP), which are highly concentrated.

## 5. Discussion

The above results show that the construction of the PP by the distribution does not follow a standard and logical construction of the value chain, that there is an asymmetric price transmission between the link of the OP and the link of the PP, that the higher the OP the smaller the difference between the PP and the OP, so that the repercussion of the costs and margins for the packaging and distribution or marketing links is more and more insufficient. There is an intention to keep the PP in a price range fixed by the distribution in order to use virgin olive oils as a commercial strategy.

Given this demonstration, packers and distributors would not have sufficient margin to be able

Table 3 - Average of the difference between prices at origin and product prices by campaigns and production of virgin olive oils over total production of olive oils.

| *Campaigns* | *Production (kg)* | *Total Production (kg)* | *Average Difference (€/kg)* |
|---|---|---|---|
| 2016/2017 | 1,081,135 | 1,281,738 | 0.61 |
| 2017/2018 | 1,060,141 | 1,238,629 | 0.95 |
| 2018/2019 | 1,453,320 | 1,790,309 | 1.18 |
| 2019/2020 | 904,889 | 1,129,233 | 1.10 |
| 2020/2021 | 1,090,984 | 1,356,411 | 0.89 |
| 2021/2022 | 1,125,308 | 1,389,566 | 0.94 |
| *Average* | *1,119,296* | *1,364,314* | *0.95* |

*Source: own elaboration based on MAPA data.*

Table 4 - Correlation index between production of virgin olive oils per campaigns and OP & PP.

| *Campaigns* | *Production (kg)* | *OP Average (€/kg)* | *PP Average (€/kg)* | *Correlation Index (kg vs OP)* | *Correlation Index (kg vs PP)* |
|---|---|---|---|---|---|
| 2016/2017 | 1,081,135 | 3.68 | 4.29 | | |
| 2017/2018 | 1,060,141 | 3.11 | 4.06 | | |
| 2018/2019 | 1,453,320 | 2.43 | 3.61 | | |
| 2019/2020 | 904,889 | 2.01 | 3.11 | | |
| 2020/2021 | 1,090,984 | 2.85 | 3.74 | | |
| 2021/2022 | 1,125,308 | 3.26 | 4.20 | | |
| *Average* | *1,119,296* | *2.89* | *3.84* | *-0.0088* | *0.1365* |

*Source: own elaboration.*

to allocate their costs and profit margins in a high OP environment. But it seems difficult to think that packers would not be able to allocate their costs and profits, since they are part of an intermediate link without any kind of requirement or reason not to do so, since they work on demand. However, this is not the case with distributors, who have to dispose of the packaged olive oils purchased and who need to have a basic product to attract consumers while maintaining control over prices.

The data presented so far support the hypothesis established regarding the effort made by the LSSGSs (distribution or retailers) to maintain these PPs within a psychological price range for the end consumer, increasing them according to the trend of the OPs, but in a smaller proportion.

Theoretically, the costs of both links and their margins should follow the concept of reasonable and coherent proportionality, but this does not seem to be the case, since in the face of OP increases of 90.31%, the PP increased by 41.56%. It could be interpreted that this difference in the speed of price growth (asymmetry) could be due to the concept of economies of scale, where the higher the volume of sales and, therefore, of purchases, the lower the production costs, but even without data on the volume of purchases by distributors, it is highly improbable that when a product becomes more expensive, demand will increase, unless it is a Giffen good, which is not the case of olive oil. As it is a standard and basic good in the shopping cart, its price is a reference for the end consumer and, hence, the effort of distribution not to pass on the increases in OPs at 100%. This fact is the second indication that could explain the use of the PP of virgin olive oils as an attraction product by the retailers.

This last consideration transfers to the study the concept of price elasticity of olive oil, where the Price and Market Observatory of the Andalusian Regional Government (Observatorio de Precios y Mercados, 2013) establishes that the consumption of virgin olive oils in Spanish households is influenced by two fundamental variables, price and family income, with a similar weight in both, although with opposite signs and with the importance of income being slightly higher. It also considers that it has the characteristic of normal goods and that demand is inelastic to price, i.e., an increase in price implies a proportionally lower reduction in consumption. Consequently, it is shown that in the face of OP increases, PPs do not rise in the same proportion because the consumer would stop buying. Therefore, the differences between PP and OP decrease.

At the statistical level, the data obtained show a positive correlation between the OP and PP price variables with an index of r = 0.82, which indicates a strong correlation between both variables. While the correlations between virgin oils yields per campaign and the OP and between the same yields and the PP are very different and neither of the two is conclusive. Thus, the correlation index between production and OP is inverse with an index r = - 0.0088 and indicates a null correlation between both variables, while for production and PP it is direct with an index r = 0.1365 with a slightly higher correlation, but also practically non-existent.

Table 5 - Construction of costs and margins for packers and distributors for extra virgin olive oil.

| *Campaigns* | *Packers* | | *Distributors* | | *Total link* |
|---|---|---|---|---|---|
| | *Cost (€/kg)* | *Margin (€/kg)* | *Coste (€/kg)* | *Margin (€/kg)* | *Packers & Distributors (€/kg)* |
| 2018/2019 | 0.470 | 0.187 | 0.270 | 0.392 | 1.319 |
| 2019/2020 | 0.470 | 0.499 | 0.272 | 0.186 | 1.427 |
| 2020/2021 | 0.514 | 0.206 | 0.282 | -0.231 | 0.771 |
| *Average* | *0.485* | *0.297* | *0.274* | *0.116* | *1.172* |

*Source: own elaboration based on Observatorio de la Cadena Alimentaria (2021a, 2021b and 2023).*

The coefficient of determination between the variables PP and OP shows an index of $R^2$ = 0.6739, which is an acceptable adjustment, with a certain predictability in the behavior of both variables.

As for the relationship between annual productions of virgin olive oils and PPs, there is practically no correlation. There is even less correlation between these same annual productions and the OPs. This may confirm and reinforce the hypothesis of asymmetry in the subsector mentioned above, since the olive mills have no control or capacity to influence on prices even when harvests are below average, while the distributors have more capacity to set prices with very different annual productions. This circumstance gives rise to the fourth indication, which points to the distribution as the main player in the value chain in terms of determining the PP following its own interests and strategy for attracting end consumers.

Finally, comparing the data of the present study with the data provided by the Agrifood Chain Observatory (Observatorio de la Cadena Alimentaria, 2021a, 2021b and 2023), the results confirmed the hypothesis that the difference between the PP and the OP is not high sufficient to be able to allocate the costs and profit margins of packers and distributors, with distributors being the most likely to fail to do so.

This is justified through the simulation carried out with the data from both studies, where the results obtained indicate that for the packaging and distribution links, the costs and profit margins of extra virgin olive oils for the 2018/2019 campaign were 1.319 €/kg, for 2019/2020 1.427 €/kg and for 2020/2021 0.771 €/kg.

These costs and margins from the Agrifood Chain Observatory (Observatorio de la Cadena Alimentaria, 2021a, 2021b and 2023), were cross-referenced with the difference between the PP and OP for the extra virgin category of the three campaigns (2018/2019, 2019/2020 and 2020/2021), establishing the assumption that the packaging link allocated 100% of its costs and margins. In this way, it was possible to analyze whether the amount in euros that remained covered the costs and profit margins of distribution.

The result obtained establishes that for the 2018/2019 campaign the distribution was able to allocate a margin to the extra virgin oil sold of 0.293 €/kg, while for the 2019/2020 and 2020/2021 campaigns, not only were they not able to allocate their margin, but this difference did not even cover their costs. The simulation estimated a negative margin for distribution for these two campaigns of -0.101 €/kg and -0.112 €/kg respectively.

In view of the above, it would be the distribution that acts strategically with the PP of extra virgin olive oils, confirming the hypothesis put forward at the beginning of this paper.

Currently, the future outlook for the euro zone is very uncertain. The arrival of Covid-19, the war in Ukraine and political instability in some European countries has led to an environment of high interest rates and inflation. In this regard, over the last year and a half, the Spanish government has implemented public policies aimed at reducing inflation by lowering VAT on certain food items, including olive oil.

We consider that the new inflation rates, although they are gradually decreasing, will allow us to pass on a new reference price to the end con-

Table 6 - Estimated distribution margin for extra virgin olive oils.

| Campaigns | Packers | | Distributors | Total link (€/kg) | OP €/kg | PP €/kg | Difference OP&PP (€/kg) | Estimated Margin Distributors (€/kg) |
|---|---|---|---|---|---|---|---|---|
| | Cost (€/kg) | Margin (€/kg) | Cost (€/kg) | | | | | |
| 2018/2019 | 0.470 | 0.187 | 0.270 | 0.927 | 2.53 | 3.75 | 1.22 | 0.293 |
| 2019/2020 | 0.470 | 0.499 | 0.272 | 1.241 | 2.12 | 3.26 | 1.14 | -0.101 |
| 2020/2021 | 0.514 | 0.206 | 0.282 | 1.002 | 2.95 | 3.84 | 0.89 | -0.112 |
| *Average* | *0.485* | *0.297* | *0.275* | *1.057* | *2.53* | *3.61* | *1.08* | *0.027* |

*Source: own elaboration based on Observatorio de la Cadena Alimentaria (2021a, 2021b and 2023).*

sumer. This will allow producers and olive mills to maintain their OPs, improving their profitability and causing the distribution to pass on the real cost of the OPs to their PPs, establishing a new reference price for olive oils in the mindset of the end consumer. If this hypothesis becomes a reality and is sustained over time, distribution will have no choice but to change its strategy.

## 6. Conclusions

The conclusions obtained reinforce the hypothesis of the strategy followed by the distributors to control PP and not to pass on 100% of the OP increases. Likewise, distributors are not imputing part or all of the costs and may be consciously incurring losses for the sake of a customer acquisition strategy. Distribution with very uneven production campaigns manages to maintain price differences, controlling PP and putting pressure on OPs. All this reinforces the hypothesis of asymmetry and distribution control over the PP of virgin olive oils.

The analysis of correlations confirms the hypothesis of asymmetry of the subsector mentioned above, since olive mills have no control or capacity to act on prices even when harvests are below average, while distributors have more capacity to establish prices with very different productions. These figures argue that production levels may not be as decisive for price setting as it could be thought at first.

Finally, the model simulation estimated a negative margin for the distributors for two of the three campaigns analyzed. There seems to be, therefore, a price range in which the distributor wishes to maintain the price of virgin olive oils, considering it the optimal price to trigger the final consumer's purchase.

The conclusions drawn confirm the hypothesis of the control and maintenance of the PP of virgin olive oils by the distributors, which makes it feasible to use them as a "lure product" or "loss leader", even when incurring possible losses. The main conclusion is that the setting of the PP of virgin olive oils is based more on a commercial strategy than on a correct sequence of prices and margins along the value chain. It shows that there is an asymmetric price transmission system.

This paper is not free of limitations. The first is that it is focused on Spain and on a specific product, so in the future it is considered as other possible lines of research to reproduce it in other countries and other sectors. The second is the lack of knowledge of the stock management criteria followed by bulk and packaged virgin olive oils because there is no published data on the subject, which could have repercussions on pricing.

We believe that the results can help those involved in the value chain to better understand the construction of the price of virgin olive oils and establish future pricing strategies to improve their profitability, especially for producers. It is necessary to generate a stronger chain in which all the links collaborate and have profits, even more so in a scenario of reduced CAP subsidies that would make many olive groves economically unviable. Paradoxically, the leading product of the Mediterranean is threatened by the malfunctioning and lack of collaboration of the different links in the chain.

Thus, a further step is taken in demonstrating the need for political action against this type of actions that endanger the permanence and conti-

nuity of producers (the weakest link in the value chain), with the importance that this implies for the economic development of rural areas, the setting of the population in these demographically disadvantaged environments, the maintenance of biodiversity and the environment. One of the main policy implications of the study is to provide Law 16/2021 on the agrifood chain with a certain value (0.95 €/kg) to reinforce it, trying to stop sales at a loss and to transfer a new reference price in the market.

For industry professionals, the study has shown that the main problem of OPs is in the PPs. In other words, the distribution strategy to keep PPs in low environment puts pressure on OPs, causing them not to reflect the real production cost. This situation of weakness may end up affecting all those involved in it.

On the academic side, our paper has contributed to establish a new figure in the value chain for the last two links that will help to improve its functioning and will lay the groundwork for further studies. Researchers could help in this area by continuing to develop studies of the chain and each link and apply it to other countries and sectors.

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