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RESEARCH ARTICLE

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The influence of family ownership in the profitability of vertically integrated companies. Evidence from the Spanish agri-food industry

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Abstract

The aim of this paper is to analyse whether the family control exerts a significant influence on profitability in agri-food companies that have been vertically integrated. This assumption is based on the idea that family-owned firms better overcome the internal conflict that arises in a company by reducing transaction costs. We have analysed the determinants of the profitability and its annual increase, considering the kind of company and its sector. Our results show that family firms tend to perform better, both from an economic and a financial perspective, than their counterparts, obtaining higher levels of efficiency with lower levels of debt. These factors lead to a higher profitability of family firms mainly attributable to the reductions of costs and financial expenses. Even though efficiency and size tend to grow if the family business is also vertically integrated, its levels of financial risk and commercial credit also increase and its sales margin decreases, which cause a trend to decrease in its profitability. These trends are independent of the year and the subsector.

Additional keywords: integration strategy; family firms; firm performance.

Abbreviations used: CI (confidence interval); EU (European Union); FF (family firms); I (integrated); IF (integrated family); INF (integrated non-family); NF (non-family); NI (non-integrated); NIF (non-integrated family); NINF (non-integrated non-family); ROA (return on assets).

Authors' contributions: Conception and design of the study: JLG. Data recollection and preparation: JM. Statistical analysis: MS. All authors interpreted the results, and wrote, read and approved the final manuscript.

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Introduction

Vertical integration occurs when a company starts to carry out activities related to the exploitation cycle of a product or service, becoming its own provider (upstream) or client (downstream). The decision to integrate vertically implies the realisation of new activities which require investments in new assets. The relevant question in this study is to analyse whether the costs associated with these investments are less than the benefits obtained from them. The variable to be explained will be economic profitability (ROA, return on assets). This variable informs about the relation between profit and investments in assets. In this study we are analysing this relation considering whether the company is vertically integrated or not.

Despite the importance of the studies analysing the determinants of profitability, most of them refer to entire sectors or whole economies (Spanos *et al.*, 2004; Erbetta *et al.*, 2013; Grau & Reig, 2015). In this paper we propose a study that distinguishes companies by subsectors. We opt for this classification because the advantages and cost savings derived from an integration strategy will depend, among other factors, on the activity of the company and the type of manufactured product. We also consider the family nature of the company because this characteristic influences the adoption of new strategies. For instance, Family Firms (FF) will only adopt an integration strategy if it improves the results and if the family is able to retain the control of the resources and the management of the company (Gallizo *et al.*, 2017).

This research is focused on the agri-food industry which includes activities of raw material transformation and food production. This sector is an important economic engine for the Spanish economy

that generated an added value of €62,000 million in 2017, 3.5% more than the previous year (Maudos & Salamanca, 2018). According to EUROSTAT, this figure represents a contribution of Spain to the added value of the European agri-food sector of 11.4%, only behind France, Germany and Italy. If we focus on Spain economy, this sector contributes 5.8% of the GDP, a percentage much higher than the average of the European Union (EU), which is at 3.6% (Maudos & Salamanca, 2018).

Some papers suggest that the solution to problems of competitiveness and profitability in the agri-food sector comes from participation in different stages of the productive process, taking advantage of economies of scale (Bhuyan, 2005). Different authors have demonstrated that the ownership form influences transaction costs and, therefore, the different possibilities of business strategies (Himmelberg *et al.*, 1999; Zhao *et al.*, 2004; Müller & Schmitz, 2016). In particular, it has been proven that the internal costs of vertical integration depend on the structure of the property and between the different forms of ownership; FF would have the lowest transaction costs (Herrero, 2011; Cadot, 2015).

Indeed, transaction costs are lower in FF due to government structures that include family culture (Soler *et al.*, 2017). The behaviours and complexities surrounding the FF tend to influence how resources are used and how activities are performed. Particularly, FF benefit from the involvement of the family members to conduct activities that are cost reducing to improve their levels of competitiveness (Memili *et al.*, 2011).

The conflict of interest that arises between the shareholders and the management of the company, known in the literature as the problem of the principal-agent, generates the so-called agency costs. However, it has been shown that this problem is minimized when family members participate in the management of the company (Ang *et al.*, 2000). This is because the context of family control allows a better performance through the union of the whole organization in a positive and constructive culture that relieves many of the internal commercial conflicts and allows the company to enjoy the advantages of vertical integration. This better performance allows these companies to reduce agency costs and obtain greater productive efficiency compared to NF firms (Galve-Górriz & Salas-Fumás, 2011).

This is nothing new. Previous research on FF have shown major differences between FF and NF firms in strategic decision-making (Gómez-Mejía *et al.*, 2011). In general, FF are more risk averse and therefore, generally more stable because the family's wealth might be tied to their firm, making family-owners wary of high-risk strategies that could diminish their wealth (Kalm & Gomez-Mejia, 2016).

In addition, FF present some characteristics that facilitate their adaptation *to vertical integration strategies*, precisely because they allow a better use of economies of scale and also a greater generation of synergies (Kang, 1998).

According to our estimates using data from SABI database (provided by Bureau Van Dijk), many companies in the agri-food industry (23.1%) have shown their preference for vertical integration in order to save costs and improve their profitability. In addition, there is a wide presence of FF in this industry (70%), all of which makes the agri-food sector an adequate framework to investigate the performance of vertical integration in relation to the attributes of family governance.

Our objective is to analyse whether the family control exerts a significant influence on profitability compared with the profitability of non-family (NF) agri-food companies, whether they are vertically integrated or not. This assumption is based on the idea that FF better overcome the internal conflict that arises in a company. It is supposed that family ownership will influence the capacity to reduce transaction costs (Demsetz & Lehn, 1985), especially when the company is integrated (Kang, 1998).

Material and methods

Data

Our data come from the agri-food sector, one of the most important for economic growth in the EU countries (Maudos & Salamanca, 2018). We have focused on the agri-food sector, not only because of its importance in the economy but also because of the high presence of FF. We have obtained the information from the SABI database and it makes up an unbalanced panel of 4,132 companies operating in the Spanish agri-food sector and, more specifically, in the following subsectors: meat, fish, fruits & vegetables and oils & fats[1]. The period

[1]The companies have been classified according to the NACE Rev. 2 codes corresponding to their main activity. The 4 subsectors include the following activities:
- Meat sector: 014 (Animal production – except 0141 Raising of dairy cattle), 015 (Mixed farming), 0162 (Support activities for animal production), 017 (Hunting, trapping and related service activities) and 101 (Processing and preserving of meat and production of meat products).
- Fishing sector: 031 (Fishing), 032 (Aquaculture), and 102 (Processing and preserving of fish, crustaceans and molluscs).
- Fruits & Vegetables sector: 0113 (Growing of vegetables and melons, roots and tubers), 0121 (Growing of grapes), 0122 (Growing of tropical and subtropical fruits), 0123 (Growing of citrus fruits), 0124 (Growing of pome fruits and stone fruits), 0125 (Growing of other tree and bush fruits and nuts), and 103 (Processing and preserving of fruits & vegetables).
- Oils & Fats sector: 0126 (Growing of oleaginous fruits) and 104 (Manufacture of vegetable and animal oils and fats).

of study runs from 2011 to 2015 and the number of firm-period observations was equal to 20,660 (4,132 × 5). This period has a great interest since it integrates the worst years of the Spanish financial crisis (2011-2012) and also the beginning of the economic recovery.

Table 1 contains the variables included in the study. These variables correspond to the profitability of the company, measured by the ROA, and the determinant factors used in Grau & Reig (2015) which are related to business management, the size of the firm and its evolution. Moreover, information about the sector in which the companies carry out their activity, whether they are FF and whether they are vertically integrated or not, is also included.

To identify which companies in the sample have adopted a vertical integration strategy, we have used the secondary activities they carry out. We have selected as integrated companies those that, apart from their main activity, also carry out secondary activities in other sections of the value chain. Companies whose main activity is classified in the primary sector (NACE - 01 and 03) are considered vertically integrated if they also carry out secondary activities related to the manufacture of food and/or distribution activities. Companies whose main activity is classified in the secondary sector (NACE - 10) are considered vertically integrated if they also carry out secondary activities related to the primary sector and/or distribution activities. Other companies

Table 1. Variables analysed.

Variable	Value
Type	NINF; INF; NIF; IF
Sector	1:Meat; 2: Fish; 3: Fruits & Vegetables; 4: Oils & Fats
Year	2011 to 2015
Indebtedness	$\log\left(\frac{\text{Total Liabilities}}{\text{Total Liabilities} + \text{Net Worth}}\right)$
Total assets	log (Total Assets)
ΔAssets	$\log\left(\frac{\text{Total Assets}}{\text{Total Assets Previous Year}}\right)$
Market share	$\log\left(\frac{\text{Net Amount of Turnover}}{\text{Net Amount of Turnover of the Sector}}\right)$
ΔMarket share	$\log\left(\frac{\text{Market Share}}{\text{Market Share Previous Year}}\right)$
Liquidity	$\log\left(\frac{\text{Current Asset}}{\text{Current Liabilities}}\right)$
Commercial credit	$\log\left(\frac{\text{Debtors}}{\text{Net Amount of Turnover}}\right)$
Cost efficiency	$\log\left(\frac{\text{Net Amount of Turnover}}{\text{Operating Costs}}\right)$
Asset turnover	$\log\left(\frac{\text{Net Amount of Turnover}}{\text{Total Assets}}\right)$
Capital intensity	$\log\left(\frac{\text{Non}-\text{current Assets}}{\text{Personal Expenses}}\right)$
Sales margin	$1-\frac{\text{Supplies}}{\text{Net Amount of Turnover}}$
Profitability	$\text{ROA}=\frac{\text{Benefits before Taxes}}{\text{Total Assets}}$

NINF: non-integrated & non-family; INF: integrated & non-family; NIF: non-integrated & family; IF: integrated & family.

in the sample are classified as non-vertically integrated companies.

To classify the companies into FF and NF firms, we have followed the criteria used by the Spanish Institute of Family Business in its study on the impact of the FF on the Spanish Economy (Family Business Institute, 2015). These criteria take into account the ownership structure and are based on the percentages of capital in the hands of an individual person or a family and their participation in the Board of Directors.

Statistical analysis

In this section we carried out a comparative analysis of the variables of the study with the companies grouped by the type of firm (see Table 1). The results of this study will be used to analyse the influence of these characteristics on the profitability of the firms, by highlighting the existing multivariate patterns in each group with respect to the determinants of the profitability.

Firstly we carried out a univariate analysis of each one of the variables using ANOVA parametric (F test) and non-parametric (Kruskall-Wallis test) techniques; secondly, we made a discriminant analysis using a multinomial logistic regression model. Due to the existence of interrelations between the classification variables, which could hinder the interpretation of the results obtained, a factor analysis is previously made. These factors will be used as explanatory variables of the profitability.

Finally, we analysed the determinants of the annual increase in profitability. We propose a similar regression model to that used in Grau & Reig (2015) in which the dependent variable is the annual increase in the profitability of each company $\Delta ROA_{i,t} = ROA_{i,t} - ROA_{i,t-1}$ and the independent variables are the annual variations of each of the covariates in Table 1. As for the previous analysis, to avoid problems of multicollinearity, we carry out a Factorial Analysis of these annual variations.

In order to check the robustness of our results, we have estimated a general model, but also models for each type of company, for each sector, and for each year. Then, we have compared the goodness of fit of these models using the LR (likelihood ratio test) against the adjusted model to all the companies and the BIC (Bayesian information criterion) of Schwarz (1978).

Results

Descriptive analysis of the variables

Most of variables were transformed logarithmically in order to increase their degree of normality (see Table 1).

Table 2 shows the frequency distribution of companies in the sample according to their sector, their family/non-family nature, and whether they are integrated or non-integrated (I/NI). It can be seen that NIF firms are predominant in the whole sample (65.09%) and also in all the sectors. On the contrary, I companies are a minority (23.30% of the sample) especially if they are NF firms (3.6% of the sample). By sector, most of the companies operate in the meat sector (44.8%) and in the fruits & vegetables sector

Table 2. Distribution of companies by sector and type.

Sector		Type of company				Total
		NINF	NIF	INF	IF	
Meat	Frequency	221	1212	50	368	1851
	% of sector	11.90	65.50	2.70	19.90	100.00
	% of type of company	48.70	44.50	33.30	45.60	44.80
Fish	Frequency	52	363	25	143	583
	% of sector	8.90	62.30	4.30	24.50	100.00
	% of type of company	11.50	13.30	16.70	17.70	14.10
Fruits & Vegetables	Frequency	139	831	61	218	1249
	% of sector	11.10	66.50	4.90	17.50	100.00
	% of type of company	30.60	30.50	40.70	27.00	30.20
Oils & Fats	Frequency	42	315	14	78	449
	% of sector	9.40	70.20	3.10	17.40	100.00
	% of type of company	9.30	11.60	9.30	9.70	10.90
Total	Frequency	454	2721	150	807	4132
	% of sector	11.00	65.90	3.60	19.50	100.00
	% of type of company	100.00	100.00	100.00	100.00	100.00

(30.2%). There is no significance difference in the type of companies by sector (row profiles). However, we can appreciate some differences in which sectors different types of companies are present (column profiles). For example, INF firms show a greater tendency to operate in the fruits & vegetables sector than other types of companies (40.7% *vs*. 30.20% of total companies) while INF companies show a lower presence in the meat sector (33.30% *vs*. 44.80% of total companies).

Table 3 shows the results obtained from a comparative analysis of the variables according to the type of company, namely, the mean values for all the variables in each group, the % of missing data, and the results for a parametric (ANOVA) and a non-parametric Kruskall-Wallis test. In this last test we show the order implied by the pairwise Wilcoxon tests with a Bonferroni correction for simultaneity. For instance, if we consider the indebtedness ratio, our results indicate 5% statistically significant differences between the 4 groups in such a way that INF>IF>NINF>NIF, *i.e.*, INF firms tend to be the most indebted companies followed by IF, NINF and NIF. Significant differences can be seen for most variables, with the exception of the increases in assets and market share.

Besides, FF carry out better management, with higher levels of asset turnover, cost efficiency and liquidity, along with lower levels of debt and commercial credit. These results show that FF tend to choose less capital-intensive technologies and support the hypothesis that a strong preference for family control leads the companies to prefer productive activities with fewer investment and external financing needs. The characteristics of the internal organization of FF allow them to achieve greater cost efficiency and profitability than NF firms (see Table 3).

The results also show that the sales margin ratio in I companies tends to be lower, indicating that they bear higher supply costs in relation to the sales volume. However, in the case of FF, they have obtained higher values of asset turnover and cost efficiency, which compensate for the seemingly negative effects of the reduction of the margins. On the contrary, this does not occur in NF firms, which show significantly lower levels of asset turnover and cost efficiency. This has to do with efficiency from a double perspective: firstly, efficiency in the use of assets and secondly, efficiency in the use of cost factors. FF demonstrate greater capacity to generate sales with fewer investments. On the contrary, this does not occur in NF firms, which show significantly lower levels of asset turnover and cost efficiency.

These patterns tend to be present, with greater or lesser force, in all the sectors (see Table S1 [suppl]) and years (results not provided for the sake of brevity but available on request) analysed. The greatest discrepancies are observed in the fishing sector, where, contrary to the general trend, the capital intensity of I companies tends to be higher than their counterparts. This is due to the greater investment needs in the sector required to the development of technological advances in fishing vessels, storage, processing and transformation that have resulted in significant amounts of fixed assets in the I companies of the sector (Souto, 2014). We can also observe that NF companies in this sector had

Table 3. Comparative study of the companies by type.

Variables	Mean					%Missing	ANOVA		Wilcoxon matched pairs signed rank test
	NINF	NIF	INF	IF	Total		F test	*p* value	
Indebtedness	0.552	0.533	0.598	0.580	0.547	10.0	37.488	0.000	INF>IF>NINF>NIF[a]
ΔAssets	0.055	0.072	0.066	0.064	0.068	7.6	2.387	0.067	NIF>NINF
ΔMarket share	0.071	0.056	0.062	0.043	0.055	8.9	1.935	0.121	No differences
Total assets	8.864	7.955	8.901	7.987	8.093	5.2	334.173	0.000	INF>NINF>IF>NIF
Commercial credit	-1.718	-1.929	-1.657	-1.837	-1.878	6.9	26.603	0.000	INF>NINF>IF>NIF
Market share	-7.847	-8.493	-7.448	-8.137	-8.315	6.0	200.806	0.000	INF>NINF>IF>NIF
Cost efficiency	-0.077	-0.034	-0.075	-0.026	-0.039	10.6	18.950	0.000	IF>NIF>INF~NINF
Capital intensity	1.362	0.983	1.187	0.882	1.011	7.0	51.175	0.000	NINF~INF>NIF>IF
Liquidity	0.401	0.552	0.289	0.410	0.498	5.7	41.894	0.000	NIF>IF~NINF>INF
Asset turnover	-0.393	-0.164	-0.253	0.144	-0.130	6.1	118.145	0.000	IF>NIF~INF>NINF
Sales margin	0.428	0.418	0.415	0.341	0.404	6.5	63.153	0.000	NIF~NINF>INF>IF
Profitability	3.914	4.590	2.418	3.959	4.314	5.4	14.982	0.000	NIF>IF>NINF>INF
Listwise observations	1,846	11,164	594	3,408	17,012				
% Listwise observations	81.3	82.1	79.2	84.5	83.3				

[a]The main value of indebtedness ratio is significantly higher in INF firms, followed by IF, NINF, and NIF. The sign ~ indicates statistically non-significant differences.

greater asset growth than FF based on capital increases and new indebtedness. The inflow of external capital has allowed an increase in investment in fixed assets in a sector that is very vulnerable to all that the globalization of markets and competition implies and in which large companies, and in particular NF groups, have developed important investments relocation plans (Lappo *et al.*, 2015).

Discriminant analysis

In order to complete the descriptive analysis of the previous section, we carried out a discriminant analysis of the four types of companies considered in the study using a multinomial logistic regression model. This analysis will allow us to interpret the influence that the type of the firm exerts on its profitability through the quantitative variables of Table 1.

Due to the existence of interrelations between the classification variables, which could hinder the interpretation of the results obtained, a factor analysis with Varimax rotation was previously carried out. The KMO of this study was 0.668 and the total number of factors identified was six with a total percentage of variation explained of 83.17%. Table 4 shows the matrix of factor loadings for the factors obtained.

We can observe the presence of six factors, namely:

a) *Factor of efficiency* which contrasts the firm's asset turnover and, to a lesser extent, its cost efficiency, with its capital intensity. The higher scores in this factor correspond to companies, mainly in the meat and fish sectors, with a greater asset turnover, higher control of their costs and low capital intensities.

b) *Factor of the size of the company* which is directly related to the total assets and the market share of the company.

c) *Factor of financial risk of the company* which contrasts its level of indebtedness with its liquidity.

d) *Factor of increase of size of the company* directly related to the increase of assets and the market share of the company.

e) *Factor of commercial credit* directly related to commercial credit to customers.

f) *Factor of sales margin* directly related to the sales margin of the company.

Figure 1 shows the 95% error plots of the mean values of the above factors by type of firms, Table 5 (column All) shows the results obtained in the multinomial logistic regression taking the type of company as a dependent variable and the factors whose scores were estimated using the regression method as independent variables. The reference category was the group of NIF firms, which is the biggest group.

The results obtained confirm the validity of most of the patterns discussed in the subsection "Descriptive analysis of the variables". The factor of efficiency significantly discriminates between FF and NF firms and also between I and NI companies, so that the higher (lower) its value the higher (lower) is the probability of that company being FF or I (NF or NI). Therefore, FF and/or I firms tend to have a greater asset turnover and cost efficiency, as well as lower capital intensity, than NF and/or NI firms.

The same occurs with the size factor. NF and/or I firms tend to be bigger than FF and/or NI firms, both in terms of assets and market share. Likewise, companies with lower financial risk (lower indebtedness and greater

Table 4. Results of the factor analysis of the covariates. Matrix of factor loadings and Communalities (charges with absolute values <0.5 have been removed).

Variables	Factors						Communality
	Efficiency	Size	Financial risk	ΔSize	Commercial credit	Sales margin	
% Total variation explained	18.96	16.73	14.69	11.36	10.78	10.66	
Capital intensity	-0.859						0.791
Asset turnover	0.848						0.909
Cost efficiency	0.508						0.736
Market share		0.925					0.918
Total assets		0.828					0.924
Liquidity			-0.899				0.849
Indebtedness			0.869				0.824
ΔMarket share				0.828			0.764
ΔAssets				0.737			0.692
Commercial credit					0.878		0.816
Sales margin						0.948	0.926

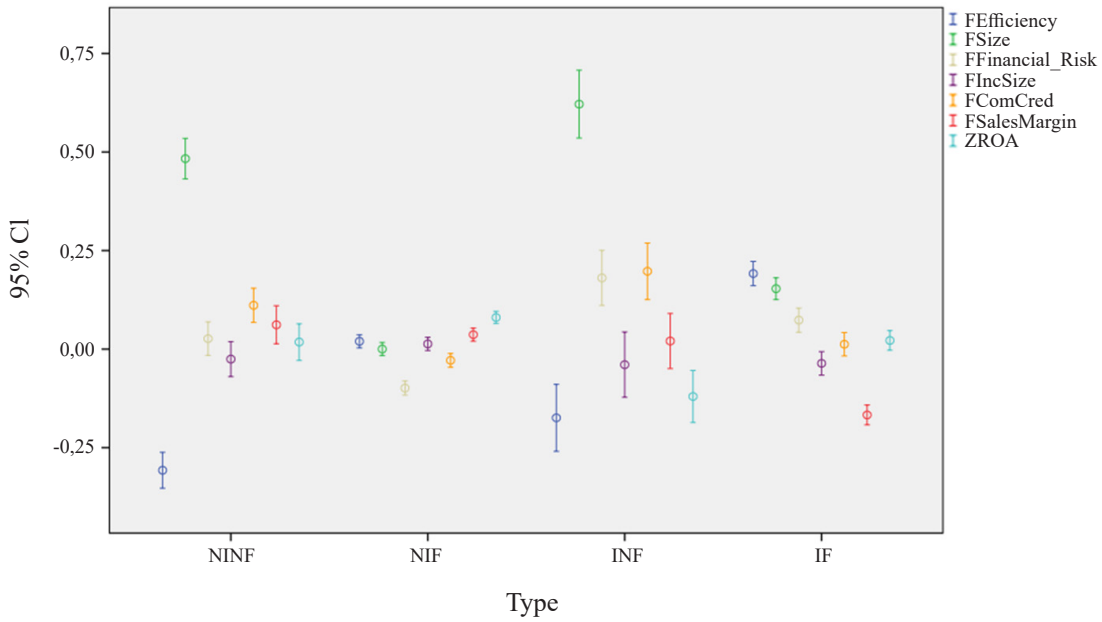

Figure 1. Factor and profitability error plots by type of firm.

liquidity) tend to be FF and/or NI firms, which are also the companies that tend to provide a lower volume of commercial credit to their customers. Finally, IF firms are the type of company that have experienced greater increases in their size (both in terms of assets and market share) and also that have lower sales margins and higher personnel expenses in relation to volume of assets.

In general, these patterns are stable both by sector (see Table 5 and Figs. S1 to S4 [suppl]) and by year (results not provided for the sake of brevity but available on request). The most significant discrepancies appear in the *Fish sector*, where IF firms tend to be smaller than the other types of companies. It is an atomized sector with a high presence of FF with a traditional structure, which are financed with resources from the owner families and have very limited indebtedness. Likewise, in the *Fruits & Vegetables sector*, NIF firms tend to have higher sales margins than other companies. This is because, in the primary activity, there is a high spatial concentration and productive specialisation in family farms with family manpower, and with an important foreign trade channel that facilitates supplies throughout the year with competitive margins. Finally, in the *Oils & Fats sector*, NF and INF companies present higher sales margin than other companies. In this case, the large cooperatives have absorbed the family groups and the small companies limit their activity to sales in bulk with no capacity to process packaged oil and distribute it. The biggest NF firms act as packaging and distribution companies, generating enough added value to allow them to obtain higher margins than companies that only produce.

In the next subsection we analyse the determining factors of the evolution of the profitability of the companies in the sample as well as of its annual increase, taking into account the company characteristics listed in Table 1, as well as the year, the sector, and the type of the company. Instead of the original variables, we used the orthogonal factors found in this section as explanatory variables in order to make easier the interpretation of the results by increasing the feasibility of the *ceteris paribus* hypothesis (due to their orthogonality), hypothesis that is usually used to interpret the regression coefficients of a model. We also calculate the standardized regression coefficients in order to determine the stronger influences on the profitability of the firm.

Determinants of the profitability evolution

We used the dynamic regression model given by the following expression:

$$\begin{aligned} ROA_{i,t} &= \beta_0 + \beta_1 COMERCIAL\_CREDIT_{i,t} + \\ &+ \beta_2 FINANCIAL\_RISK_{i,t} + \beta_3 EFFICIENCY_{i,t} + \\ &+ \beta_4 \Delta SIZE_{i,t} + \beta_5 SALES\_MARGIN_{i,t} + \beta_6 SIZE_{i,t} + \\ &+ \beta_7 DUMFAMVI_{NoNo} + \beta_8 DUMFAMVI_{YesNo} + \\ &+ \beta_9 DUMFAMVI_{YesYes} + \beta_{10} DSECTOR_{i,Fisch} + \\ &+ \beta_{11} DSECTOR_{i,Fruits\_vegetables} + \beta_{12} DSECTOR_{i,Olis\_Fats} + \\ &+ \beta_{13} DYEAR_{2012,t} + \beta_{14} DYEAR_{2013,t} + \beta_{15} dyear_{2014,t} + \\ &+ \beta_{16} DYEAR_{2015,t} + \varepsilon_{i,t} \; with \varepsilon_{i,t} \sim N(0, \sigma^2); \; i = 1, \ldots, \\ &M, \; t \in T_i \end{aligned} \quad (1)$$

where DY_i denotes a dummy variable associated with the indicator Y and T_i is the period of observed data for

Table 5. Results of the multinomial regression of the type of company on the covariates used in the study.

		Meat	Fish	Fruits & Vegetables	Oils & Fats	All
NINF	Constant	-1.852 ***	-2.478 ***	-1.844 ***	-2.363 ***	-1.983 ***
	Efficiency	-0.356 ***	-0.577 ***	-0.334 ***	-0.473 ***	-0.377 ***
	Size	0.464 ***	0.836 ***	0.559 ***	0.703 ***	0.536 ***
	Financial risk	0.233 ***	0.059	0.030	-0.051	0.125 ***
	ΔSize	-0.061	0.212 ***	-0.162 ***	0.036	-0.047
	Commercial credit	0.105 **	0.174 **	0.085	0.414 ***	0.172 ***
	Sales margin	0.115 **	-0.239 *	-0.194 ***	0.450 ***	0.023
INF	Constant	-3.598 ***	-2.798 ***	-2.762 ***	-3.564 ***	-3.193 ***
	Efficiency	-0.039	-0.773 ***	-0.241 ***	0.044	-0.223 ***
	Size	0.588 ***	0.616 ***	0.698 ***	0.634 ***	0.663 ***
	Financial risk	0.490 ***	0.355 ***	0.239 ***	0.281 *	0.320 ***
	ΔSize	-0.238 **	0.107	-0.122	0.211	-0.063
	Commercial credit	0.468 ***	0.316 ***	0.051	0.571 ***	0.316 ***
	Sales margin	-0.266 ***	-0.524 ***	-0.194 **	0.953 ***	-0.001
IF	Constant	-1.340 ***	-0.654 ***	-1.219 ***	-1.352 ***	-1.241 ***
	Efficiency	0.382 ***	0.224 ***	0.065 *	-0.127 *	0.223 ***
	Size	0.217 ***	-0.230 ***	0.175 ***	0.217 ***	0.184 ***
	Financial risk	0.169 ***	0.294 ***	0.223 ***	0.072	0.194 ***
	ΔSize	-0.107 **	-0.048	-0.068 *	0.041	-0.069 ***
	Commercial credit	-0.059	0.172 ***	0.063	0.207 ***	0.043 *
	Sales margin	-0.199 ***	-1.172 ***	-0.321 ***	0.098	-0.250 ***
Goodness of fit	R^2 Cox & Snell	0.070	0.230	0.080	0.102	0.074
	R^2 Nagelkerke	0.083	0.266	0.094	0.123	0.087
	R^2 McFadden	0.039	0.130	0.043	0.061	0.040

***, **, *: p <0.01, <0.05 and <0.1, respectively.

the i-th company. $DUMFAMVI_{NoNo}$ has the value 1 if the firm is a NF and NI business, etc. In the regression we only used company-year observations for which there was information for all the variables analysed, which meant a total number of 17,012 observations. The estimations obtained are shown in Table 6.

We can observe that the regression coefficients for all the factors are significant at the 5% of confidence level and they show that low levels of financial risk, commercial credit to costumers and capital intensity, together with high asset turnover, cost efficiency and sales margin are characteristics that contribute to increasing the profitability of companies. Likewise, the largest companies and those that have experienced a growth in their size have tended to be more profitable than the others. In relative terms (beta standardized) the strongest effects correspond to efficiency, sales margin and increment of size of the firm.

We also observed that the type of the company exerts a significant influence on Profitability. Specifically, the results show that, under *ceteribus paribus* on the above factors, NIF firms tended to obtain higher levels of profitability than the other types. We can also observe that the Fish sector has obtained lower levels of profitability than the others, and the firms experienced a significant increase in its profitability in 2015.

In order to analyse the robustness of these results, we have also estimated the previous model for each type of company, for each sector, and for each year. Table 7 shows the results obtained after comparing the goodness of fit to the data of the above models. The results indicate that the best fit corresponds to the models adjusted for each sector.

Table 6 shows the estimations of the regression coefficients of the model adjusted by sectors. The sign of the influence of the factors on the profitability is the same in all the sectors. However, there are significant differences in the intensity of this influence in absolute and relative terms: the effects of efficiency, sales margin and size of the firm in the Fish sector and of efficiency, sales margin and commercial credit in the Fruits & Vegetables sector tended to be higher than in the rest, while the effects of the commercial credit and the financial risk factors in the Fish sector and of

Table 6. Results of the regression of the profitability on the factors of the study.

Variables	Meat		Fish		Fruits & Vegetables		Oils & Fats		All	
	Beta	Beta Std	Beta	Beta Std	Beta	Beta Std	Beta	Beta Std	Beta	Beta Std
Constant	3.628 ***		1.839 ***		4.205 ***		3.933 ***		4.119 ***	
Commercial credit	-1.054 ***	-0.110	-0.799 ***	-0.084	-1.495 ***	-0.135	-0.511 ***	-0.063	-0.940 ***	-0.096
Financial risk	-1.193 ***	-0.135	-1.022 ***	-0.088	-1.247 ***	-0.123	-1.103 ***	-0.145	-1.225 ***	-0.128
Efficiency	1.826 ***	0.206	4.602 ***	0.299	2.860 ***	0.291	1.749 ***	0.212	2.373 ***	0.244
ΔSize	2.128 ***	0.208	2.963 ***	0.249	1.979 ***	0.204	1.045 ***	0.140	2.038 ***	0.205
Sales margin	1.973 ***	0.208	5.576 ***	0.371	2.900 ***	0.232	1.163 ***	0.159	2.388 ***	0.231
Size	1.641 ***	0.180	3.318 ***	0.265	1.680 ***	0.162	1.364 ***	0.195	1.613 ***	0.167
DNFNI	0.615	0.025	1.052	0.026	-2.235 ***	-0.071	-0.941	-0.034	-0.395 *	-0.013
DINF	-1.944 ***	-0.038	0.135	0.003	-2.550 ***	-0.055	-1.606	-0.031	-1.936 ***	-0.039
DIF	-0.185	-0.009	0.810	0.031	-0.662 **	-0.026	0.287	0.014	-0.395 **	-0.017
DYear2012	0.354	0.018	-0.625	-0.023	0.707 *	0.029	-0.377	-0.018	0.278	0.012
DYear2013	0.571	0.029	-1.804 ***	-0.065	1.047 ***	0.043	-0.370	-0.018	0.285	0.013
DYear2014	1.219 ***	0.062	-2.100 ***	-0.075	-0.196	-0.008	-0.181	-0.009	0.155	0.007
DYear2015	0.786 ***	0.039	0.489	0.017	0.764 *	0.030	1.013 *	0.049	0.863 ***	0.037
DSector Fish									-1.146***	-0.043
DSector FruitVeg									0.007	0
DSector Oil Fats									-0.070	-0.002
Observations	7,895		2,306		5,072		1,739		17,012	
R^2 adjusted	0.179		0.261		0.244		0.161		0.197	
Error measurement	7.164		9.653		8.640		7.489		8.153	

***, **, *: p <0.01, <0.05 and <0.1, respectively.

most of the factors in the Oils & Fats sector tended to be lower. Besides, there were not significant specific type effects in the Fish and Oils & Fats sectors, and only a negative specific effect in the INF firms in the Meat sector. Finally, and besides the increase of the profitability in 2015 for the firms of all sectors, it can be noticed specific increases in 2014 in the Meat sector, decreases in 2013 and 2014 in the Fish sector (which was the most affected by the crisis) and a significant increase in 2012 and 2013 in the Fruits & Vegetables sector.

Determinants of the annual increase in profitability

As in the previous section, to avoid problems of multicollinearity, we have carried out a Factorial Analysis of these annual variations. The number of factors extracted is 6 and they explain 81.38% of the total variance. Table 8 shows the matrix of factor loadings after applying a VARIMAX rotation.

The extracted factors are:

a) *Factor of increase of sales* which evaluates the annual increase of a company in relation to its assets, its market share and its commercial credit.

b) *Factor of company size* which is directly related to the total assets and the market share of a company.

c) *Factor of increase of sales margin* that evaluates the increase of the sales of a company in relation to its operating costs and supply expenses.

d) *Factor of increase in financial risk* that evaluates the annual variation of the indebtedness of a company in contrast to its liquidity.

e) *Factor of increase of size* that is directly related to the growths of total assets and market share.

f) *Factor of increase in capital intensity* that is directly related to the annual variation of the capital intensity of a company.

The regression model used to analyse the determinants of the annual variation of the profitability of a company is given by the following expression:

Table 7. Comparison of the adjusted models for profitability and its annual variation (model with better fit in bold, *p* value in parenthesis).

Dependent variable	Criterion	All companies	Distinguishing by		
			type	sector	year
Profitability	LR (*p* value)		327.302 (0.0000)	969.982 (0.0000)	241.100 (0.0000)
	BIC	4.2065	4.2096	**4.1717**	4.2128
Profitability annual variation	LR (*p* value)		192.309 (0.0000)	326.650 (0.0000)	1143.081 (0.0000)
	BIC	4.2633	4.2766	**4.2047**	4.2655

$LR(M) = 2\log\left(L\left(\hat{\theta}_M\right)\right) - 2\log\left(L\left(\hat{\theta}_{M_0}\right)\right)$ where M_0 is the regression model adjusted to all the companies. *p* value = $P\left[\chi^2_{\dim\left(\hat{\theta}_M\right)-\dim\left(\hat{\theta}_{M_0}\right)} \geq LR\left(M\right)\right]$. $BIC(M) = \frac{-2\log\left(L\left(\hat{\theta}_M\right)\right) + \dim\left(\hat{\theta}_M\right)\log(n)}{n}$ where n = number of observations and $\hat{\theta}_M$ is the MLE of $\hat{\theta}_M$ vector of parameters of the model M.

$$\begin{aligned}\Delta ROA_{i,t} &= \beta_0 + \beta_1 \Delta SALES\_VOLUME_{i,t} + \beta_2 SIZE_{i,t} + \\ &+ \beta_3 \Delta MARGIN_{i,t} + + \beta_4 \Delta FINANCIAL\_RISK_{i,t} + \\ &+ \beta_5 \Delta SIZE_{i,t} + \beta_6 \Delta CAPITAL\_INTENSITY_{i,t} + \\ &+ \beta_7 DUMFAMVI_{NoNo} + \beta_8 DUMFAMVI_{YesNo} + \\ &+ \beta_9 DUMFAMVI_{YesYes} + \beta_{10} DSECTOR_{i,Fisch} + \\ &+ \beta_{11} DSECTOR_{i,Fruits\_vegetables} + \beta_{12} DSECTOR_{i,Oils\_Fats} + \\ &+ \beta_{13} DYEAR_{2012,t} + \beta_{14} DYEAR_{2013,t} + \beta_{15} DYEAR_{2014,t} + \\ &+ \beta_{16} DYEAR_{2015,t} + \varepsilon_{i,t} \; with \varepsilon_{i,t} \sim N(0, \sigma^2); i = 1,..., M, \; t \in T_i\end{aligned} \quad (2)$$

where DY_i denotes a dummy variable associated with the indicator Y and T_i the period of observed data for the i-th company. In the regression we only used company-year observations for which there was information for all the variables analysed, which meant a total number of 13,325 observations. The estimations obtained are shown in Table 9 column "All".

We observed a significant upward trend in annual profitability of around 0.48%, with the exception of companies operating in the Fruits & Vegetables sector, which experienced a negative growth of -0.054%. In addition, the coefficients of the factors are all significant at 1% of confidence. These coefficients show that having increases in the sales, in the sales margin and in the size of the firm, as well as having decreases in the financial risk and in the capital intensity, are factors that favour an increase in the profitability of the company. The size of the company is a factor directly and weakly related to its increase in its profitability (it is significant at 5% but not at 1%). In relative terms (beta standardized) the strongest effects correspond to variations in financial risk, sales margin and sales volume. In addition there are not significant specific effects of the type of the firm and the year.

Table 8. Results of the factorial analysis of the covariates used in the study of the profitability variation. Matrix of factor loadings and Communalities (charges with absolute values < 0.5 have been removed).

Variables	Factor						Communality
	ΔSales volume	Size	ΔSales margin	ΔFinancial risk	ΔSize	ΔCapital intensity	
ΔCommercial credit	-0.799						0.707
ΔAsset turnover	0.753						0.828
ΔMarket share	0.638				0.527		0.814
Total assets		0.911					0.832
Market share		0.905					0.830
ΔSales margin			0.904				0.834
ΔCost efficiency			0.759				0.756
ΔLiquidity				-0.856			0.816
ΔIndebtedness				0.793			0.780
ΔAssets					0.897		0.850
Δ Capital intensity						0.940	0.905
% Total variation explained	16.75	15.07	14.51	12.54	12.08	10.44	

Table 9. Results of the regression of the annual increase of the profitability on the factors of the study.

Variables	Meat		Fish		Fruits & Vegetables		Oils & Fats		All	
	Beta	Beta Std	Beta	Beta Std	Beta	Beta Std	Beta	Beta Std	Beta	Beta Std
Constant	0.420 **		0.372		0.292		-0.271		0.480 ***	
ΔSales volume	1.689 ***	0.163	2.491 ***	0.210	2.301 ***	0.197	1.032 ***	0.127	1.813 ***	0.169
ΔFinancial risk	-2.239 ***	-0.234	-3.628 ***	-0.298	-3.087 ***	-0.284	-2.534 ***	-0.255	-2.876 ***	-0.272
ΔCapital intensity	-0.375 ***	-0.039	-0.717 ***	-0.057	0.414 **	0.034	0.065	0.006	-0.221 **	-0.020
ΔSize	0.730 ***	0.076	2.886 ***	0.231	0.910 ***	0.085	1.094 ***	0.114	1.258 ***	0.119
ΔSales margin	2.110 ***	0.187	4.898 ***	0.226	3.595 ***	0.255	1.395 ***	0.190	2.544 ***	0.207
Size	0.200 **	0.025	-0.115	-0.009	0.372 **	0.035	-0.140	-0.017	0.156 **	0.016
DNFNI	0.020	0.001	-1.603*	-0.038	0.250	0.008	0.714	0.022	-0.012	0.000
DINF	-0.440	-0.009	-0.718	-0.013	0.105	0.002	-2.521*	-0.043	-0.390	-0.008
DIF	-0.058	-0.003	-0.096	-0.004	-0.050	-0.002	0.340	0.014	-0.037	-0.002
DYear2013	-0.111	-0.007	-0.702	-0.026	-0.251	-0.011	0.031	0.001	-0.299	0.003
DYear2014	0.553 **	0.034	0.821	0.030	-1.689 ***	-0.071	1.357 *	0.062	-0.085	-0.027
DYear2015	-0.647 ***	-0.039	2.550 ***	0.090	0.217	0.009	0.991	0.045	0.192	-0.001
DSector Fish									0.080	0.003
DSector FruitVeg									-0.534 ***	-0.027
DSector Oil Fats									-0.041	-0.001
Observations	6,174		1,766		3,960		1,325		13,225	
R^2 adjusted	0.110		0.232		0.227		0.137		0.161	
Error measurement	6.749		10.447		9.091		8.816		8.389	

***, **, *: p <0.01, <0.05 and <0.1, respectively.

In order to analyse the robustness of these results, Table 7 shows the results of the comparison of the adjusted models distinguishing by type, years or sector of the company. It can be noticed that the best goodness of fit corresponds to the model that distinguishes by sector. If we analyse the estimated regression coefficients of this model (see Table 9) it can be noticed that the sign of the significant influences of these factors on the increase of profitability are the same in all the sectors, being the Fish and Fruits & Vegetables the sectors where the intensity (absolute value of the coefficients) of these effects is higher than in the rest.

Besides, only the companies operating in the Meat sector experienced, overall, a weak and significant increase in their profitability estimated at 0.42%. The profitability of this sector increased to 0.973% in 2014 and decreased to -0.227% in 2015. In turn, companies operating in the Fish sector experienced a profitability growth of 2.55% in 2015, while the profitability of companies in the Fruits & Vegetables sector decreased by -1.689% in 2014. There were not 5% significant specific effects in any of the sectors.

Discussion

In this paper we have studied the factors of the profitability of a company analysing its relationship with the vertical integration strategy in a sectorial and dynamic study. We have also analysed whether the family control of Integrated agri-food firms exerts a significant influence on profitability.

The study is focused on the agri-food industry, which includes activities of transformation of raw materials and food production. This industry is an adequate framework to carry out this analysis due to the existence of a large number of FF. This kind of companies, due to their preference for transmitting the company to future generations, are interested in carrying out new, related diversification activities within the value chain and take advantage of economies of scale that allow them to obtain improvements in profitability. The structure of these companies is traditional; they are mainly financed with resources from the owner families, with a very limited debt. They have as objectives the creation of value and the survival of the company.

The results obtained show that FF in the agri-food sector in Spain are smaller but more efficient in the use of their resources than NF firms. In addition, they present lower levels of debt and higher levels of liquidity, all of which generates greater profitability and greater increases of profitability.

In all these sectors, the size factor has an influence on the profitability of the firm, but it is in the Fish sector where this difference is significant with greater intensity, compared to the rest of the sectors. According to the experts (EUMOFA, 2019), companies in the fishing sector do not have enough dimension and require diversification. The shortage of size of the firms prevents achieving economies of scale and being competitive in costs, therefore, restructuring is recommended. However, this restructuring is not attractive for financial institutions that should inject funding to achieve productivity and innovation in the sector due to the low profitability of these companies (EUMOFA, 2019). In that sense, the fishing sector has suffered a specific problem in the profitability in recent years, whose origin is in the fall of fish consumption. This fall initially observed during the economic crisis has continued until to date with a decrease of 15% during the last five years, which has eroded the profitability of companies in the sector (EUFOMA, 2019).

Contrary to Fishing sector, the Fruit & Vegetable sector increases its profitability significantly since 2012, which is explained by the greater intensity of the "sales margin factor". The improvement of this margin has been achieved through two important reforms: i) the concentration of companies, expanding their purchasing capacity and ii) the development of distribution platforms that centralize, segment and organize fresh products (Villafuertes & Torres, 2015). We have also observed a greater influence of the “commercial credit factor” on the profitability in the fruit and vegetable sector. In this sector, the "commercial credit factor" plays in favour of firms, highlighting the financial business associated to distribution (Villafuertes & Torres, 2015), in fact, commercial credit is of greater intensity in the fruit and vegetable sector and has favoured improvements in profitability.

In addition, we noticed that the size of the firm is the factor that most influences the growth of profitability. In the Spanish case, the size of the firms is the most notable deficiency of the agri-food sector, there, the vast majority of companies are small (Uclés & Teruel, 2012). Therefore, increasing the size should be the objective of the firms for the coming years.

In general, our results are quite similar to that of Grau & Reig (2015): higher cost efficiency, with high asset turnover, less financial risk, large size and increased growth in size contribute to obtain greater levels of profitability and greater growth of these levels. Besides, if we refer to efficiency these results are consistent with those of other authors (Anderson & Reeb, 2003; Martikainen *et al.*, 2009; Galve-Górriz & Sálas-Fumás, 2011) who have analysed the performance of FF using different data and focusing on other industries. They found a greater efficiency in the management control of FF due to a significant reduction of agency conflicts.

We also provide evidence that the sign of the influence of these variables is independent of the type of the company, the year, and the subsector in which the company operates, but not their intensity, which is higher in the firms of the Fish and Fruits & Vegetables sector.

In addition, we have also considered the Intensity of Capital. This indicator captures, indirectly, the investment effort of the company in fixed assets, and it presents an inverse relationship with profitability. Thus, the agri-food companies in the sample that have been vertically integrated, with new investments in fixed assets, have experienced a negative evolution of their profitability, which cause doubts on the effectiveness of this strategy.

Focusing on FF, the efficiency factor and the size factor increase if these companies are vertically integrated, although their profitability decreases slightly due to their lower sales margin and higher levels of financial risk and commercial credit. On the contrary, NF and NI firms (and, in the case of Fish sector all the vertically integrated firms) have lower levels of profitability due to their higher levels of financial risk and commercial credit, which are not compensated by their higher size. In general, these results are robust if the analysis is repeated by type of company, sub-sector and year.

These results have implications for the Spanish agri-food industry, where companies have to decide on their organizational limits. The decision to innovate through i) the outsourcing of a part of the production process or ii) vertical integration in the value chain, is a dilemma that is present among the set of FF and NF agri-food companies (Materia *et al.*, 2017). Here our results can help the decision-making by showing that the agri-food FF are more efficient in the use of their assets than the NF ones, because their investment decisions are made with longer term scope and lower levels of indebtedness. When these companies are vertically integrated, a decrease in profitability is observed because the sales margin is lower, and their financial risk increases due to the greater capital needs. Therefore, FF are eventually forced by the market conditions to a change of strategy. If they decide to stay as they are, their chances of expansion will be limited to

their current position in the market. On the contrary, if they decide to face a vertical integration, they will have to make new investments which probably will provide a greater volume of business. For the FF, this change in the strategy will mean two possible consequences: i) a loss of control of the firm by the family due to the entry of new partners in a possible capital increase, affecting the firm's socioemotional wealth or ii) higher financial expenses from new financing needs which results in a fall of profitability. So, both consequences should discourage family owners of adopting vertical integration strategies in this sector.

As in previous works (Short *et al.*, 2006; Zouaghi *et al.*, 2017) our results indicate that size is the factor that most influences the growth of profitability. The small size of the firms is the most notable deficiency of the agri-food sector, where the vast majority of companies are SMEs and micro-companies. The business dimension is related to the competitive advantages that innovation, internationalization and access to financing bring to it (Uclés & Teruel, 2012). Therefore, if firms in the agri-food sector want to obtain profitability increases in the current context of international competitiveness, the clearest recommendation would be to gain size, or adopt commercial agreements or business combinations.

These results correspond to the Spanish agri-food sector and it would be interesting to extend the study to other countries and sectors where the economic and environmental circumstances might be different. Besides, it would be interesting to analyse if there are significant differences between upstream and downstream integrating firms and to incorporate the degree of vertical integration of the firms in the determinant factors of the profitability.

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