

Business strategies, profitability and efficiency of production[‡]

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Abstract

The strategy choices of market-oriented companies are a topic now under wide investigation in the analysis of business performance antecedents. The purpose of this study is to examine the outcomes of the combination of three different organizational strategies (market orientation, innovativeness and entrepreneurial orientation) on business performance indicators. Models using profitability and efficiency indicators are proposed with the specific aim of obtaining a deeper analysis of the relative roles played by each. The empirical work takes place in the agro-food industry in the Ebro Valley, one of Spain's most competitive regions. The estimates from profitability quantile and truncated regressions of the efficiency scores reveal that market orientation has a positive effect on economic and productivity performance. The impact of pro-active, innovation-seeking, and risk-averse entrepreneurship is nevertheless more debatable, despite some influence of these entrepreneurial styles on observed performance values. This enables conclusions regarding the possibility of combining a market-oriented business culture with innovation and entrepreneurial activity with a view to obtaining business performance gains.

Additional key words: efficiency; entrepreneurial orientation; innovativeness; market orientation; ROA.

Introduction

The underlying concept of market orientation (MO) is not new. The focus of the relevant research narrows gradually towards finding an accurate means of measuring the concept and analyzing its effects on organizational performance (Narver & Slater, 1990; Spillan & Parnell, 2006). The majority finding from all the existing research is that the more market oriented the firm, the better its performance (Vázquez *et al.*, 2001; Haugland *et al.*, 2007).

Various scholars note the performance effects of other competitive business strategies, apart from mar-

ket orientation. Two examples are entrepreneurial orientation (Schindehutte *et al.*, 2008), and innovativeness (Miles & Snow, 1978; Simpson *et al.*, 2006), with greater impact of the latter than to the former. Nevertheless, despite the fact that the literature tends to treat the two approaches as complementary rather than mutually exclusive, exists little research on their joint effect on firm performance.

The present study aims to contribute further empirical evidence about the relationship between the above-mentioned organizational strategies and firm performance, by incorporating three features that are novel to the research. The first is the fact that, in addition to

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This work has a Supplementary Table that does not appear in the printed article but that accompany the paper online.

Abbreviations used: Bdi (innovation seeking); CEO (chief executive officer); CFI (confirmatory fit index); Cif (interfunctional coordination); DEA (data envelopment analysis); GDP (gross domestic product); GFI (goodness of fit); IC (interval confidence); IFI (incremental fit index); Inn (innovativeness); K (fixed assets); KMO (Kaiser-Meyer-Olkin test); L (number of workers); MO (market orientation); NFI (normed fit index); Ocl (customer orientation); Oco (competition orientation); OOC (other operating costs); Pro_Adr (pro-activeness and risk aversion); RM (raw materials); RMR (root-mean-square residual index); RMSEA (root-mean-square error of approximation); ROA (return on assets); ROI (return on investments); SABI (Iberian —Spain and Portugal— balance sheet analysis system); SMES (small and medium sized enterprises); Y (operating income).

the traditional return on assets ratio (ROA), a richer characterization of the firm performance appears by using data envelopment analysis (DEA). Instead of computing a simple accounting measure of profitability, DEA technique (Charnes *et al.*, 1978) compares several input resources and output results and provides a synthetic index of efficiency for each firm. Using more information than profitability ratios, DEA estimates are also less sensitive to measurement errors and creative accountability.

The second consists of a simultaneous analysis of the impact on these performance measures of the different business orientations (market orientation, innovativeness, and entrepreneurial orientation). The third is that robust methods are used to compute regressions results. The relationships between ROA ratio and business orientations are estimated by quantile regression (Koenker & Basset, 1978). This requires fewer assumptions than ordinary least squares and overcomes problems such as outliers, heteroscedasticity and non-normal residual distributions. In the case of DEA efficiency scores, an approach based on truncated regressions with bootstrap (Simar & Wilson, 2007) solves problems of serial correlation of the dependent variable and permits consistent statistical inference.

The empirical work takes place in the agro-food industry of the Ebro Valley, one of Spain's most competitive regions located in the North East part of Spain. Additionally, the agro-food industry is an important economic sector by employment and profitability. The resulting analysis will have implications for businesses by offering guidelines to improve their positioning in an increasingly complex competitive environment.

Conceptual framework. Strategies and business achievements

Strategies

Market orientation

Market orientation promotes the understanding and management of the firm's customer data, data on rivals, and environmental forces, for collective treatment within the organization in order to create and sustain an offer that will bring the firm added value (Narver & Slater, 1990; Appiah, 1998; Bigné *et al.*, 2000; Vázquez *et al.*, 2001; Spillan & Parnell, 2006). The ultimate goal of

the organization is to respond to market needs and anticipate them by providing a more satisfactory offer than that of its competitors. This concept of market orientation (MO) has been extensively researched during the last few decades. Numerous definitions of MO have been put forward since the seminal definition. The behavioural approach proposed by Kohli & Jaworski's (1990) seminal work on MO and the cultural approach adopted by Narver & Slater (1990) and Slater & Narver (1994) afterwards are the two main theoretical frameworks that have most successfully guided the conceptualization of the MO. The behavioural approach includes both customer-oriented and competitive behaviours as well as inter-functional coordination, meaning dissemination of information between departments (Kohli & Jaworski, 1990). The cultural approach was initially proposed for one construct that was covering three dimensions (attention to customers, competitors and inter-functional coordination). However, later studies (Desphandé & Farley, 1998; Álvarez *et al.*, 2000) successfully proved the hypothesis that true market orientation, defined as a culture that commits the organization to the continuous creation of superior value for customers, takes place when there is a close relationship between behaviour and culture.

Nevertheless, some authors, including Álvarez *et al.* (2000), claim that the two analytical perspectives are complementary. These authors successfully test the hypothesis that true market orientation requires the cultural facet to be closely linked to the operational facet. In the same vein, Sanzo *et al.* (2003) assume that market orientation manifests itself on the cultural level. This means that an organization adopts certain attitudes in order to meet market needs, but that its presence requires the effective implementation of actions, first to identify and then to satisfy those needs. These authors consider more attitude-driven behavior in their construction of a causal model where market orientation is an influential factor in the choice of business strategy.

Motivated by the above observations, the paper focuses on the measurement of market orientation following the scale MARKOR proposed by Narver & Slater (1990). This scale includes the customer-oriented and competitive behaviors as well as inter-functional coordination, and so relates behavior and culture. More details appear in the methodology section. In addition, this sector receives less attention than others in connection with the measurement of the business orientations selected for analysis and their repercussions

on organizational performance. Nevertheless, special mention must be made of Arcas (2003), Kara *et al.* (2005) and López (2006), studies that reach beyond other research by proposing the use of different measuring techniques for the small and medium sized enterprises (SMES) that are relevant in the European context.

Entrepreneurial orientation

Definition of the concept of entrepreneurial orientation finds a starting point and reference in the view put forward by Schumpeter (1934), who describes the role of entrepreneur as one who carries out new combinations, or concentrates on the introduction of new goods, the conquest of a new source of supply of raw materials, or the creation of new organizations or industries. Building upon this initial basis, entrepreneurial orientation has often been defined as a type of strategic orientation as the willingness to engage in entrepreneurial behavior (Aloulou & Fayolle, 2005). One of the main proposals in strategic orientation terms is that of Miles & Snow (1978), in what they define as the “prospective” type of strategy, which supports organizational aggressiveness in the form of the introduction of new goods or the discovery of new market opportunities.

Building on these initial ideas, this paper takes up the proposal adopted by Miller (1983) and Blesa & Ripollés (2005), which defines the entrepreneurial orientation construct as possessing the following three features: continual search for innovation, pro-activeness, and moderate risk taking (Covin & Slevin, 1989; Lumpkin & Dess, 1996, 1997). The search for innovation relates to entrepreneurial orientation in that the latter materializes both in new resource creation and new combinations of known resources (Zahra *et al.*, 1999). Pro-activeness means taking the initiative in the effort to model the environment in order to gain a competitive advantage. Risk taking, as part of an entrepreneurial orientation, means being prepared to take a moderate risk in strategic decision-making. Entrepreneurial behavior, as defined in this paper, therefore involves an innovative attitude. Salient contributions among the recent literature on this style of strategic orientation include Schindehutte *et al.* (2008), who demonstrate the important role of entrepreneurship in the market in the competitiveness at the international level.

Innovativeness

The term innovation acquires a wide variety of meanings. Zaltaman *et al.* (1973) define the innovation as the new product development process, new products in themselves, and the process involves in adapting such products. The innovation phenomenon can be explored at various levels: the industrial sector, the region, the firm and the project. In recent years, much research has been undertaken to measure ways for firms to become innovative and how each of them relates to the structure, culture and management of the organization (Zaltaman *et al.*, 1973; Calantone *et al.*, 2002; Simpson *et al.*, 2006; Furtan & Sauer, 2008; Salavou & Avlonitis, 2008; among others).

The literature has also identified a positive relationship between market orientation and innovativeness. Kohli & Jaworski (1990), Slater & Narver (1994) and Desphandé & Farley (1998) suggest that market orientation practices result in a high level of innovation. Along the same lines, Atuahene-Gima (1996) detects that market orientation has a decisive influence on the profitability of new-product and service innovations. Vázquez *et al.* (2001) find empirical confirmation of the fact that market-oriented high-tech companies display a better innovation performance, and a high new-product success rate. In the same line Quinn (1986) discovers a strong market orientation in the innovating enterprises observed for his study, and Zirger & Maidique (1990) who identify deep customer and market knowledge as a primary factor in their model of new product development. Bigné *et al.* (2000) suggest market orientation as a good source of innovation.

Hurley & Hult (1998), Siguaw *et al.* (2006) and Laforet (2008) suggest various methods for assessing the relationship between market orientation and innovation and for determining the conditions under which the relationship holds. For a final reference in this line of reasoning, Desphandé & Farley (1998), who reach the assertion that the clearest proof of market orientation is the success of an innovation. All these relationships are therefore consistent with the very basis of market orientation, which is to enable the firm to respond more rapidly to changes in market needs by launching new or improved products. This general theoretical basis should also be present in the industry selected for analysis. In general, therefore, these authors have established that making efforts towards innovation is good for agri-food companies. However, it is true that

a direct and immediate relationship with profits is not always seen (De Jong & Vermeulen, 2006; EC, 2007; Anderson & Tyler, 2008; Mamaqui *et al.*, 2009).

Business achievements

The research on the relationship between market-oriented, entrepreneurial-oriented, and innovativeness business activities and firm performance tends for the most part to use performance measures based on profitability indicators. Some of the first contributions on market orientation worth mentioning are Narver & Slater (1990), who claim that the underlying aim of market orientation is profitability, considered more as a component than a construct. Nevertheless, empirical evidence present by the same authors fails to confirm the latter assumption, since they report—in the same vein as Kijewski & Gross (1990)—that managers perceive profitability to be the result of market orientation.

Several subsequent studies maintain this line of reasoning about the relationship between market orientation and firm performance, using various measures. The most common are ROA, return on investment (ROI), market share, sales volume, margin over sales, relative growth and new product success (Slater & Narver, 1994; Atuathene-Gima, 1996; Appiah, 1998; Vázquez *et al.*, 2001; Bello *et al.*, 2003; Aldas-Manzano *et al.*, 2005; López, 2006; Baker & Sinkula, 2007; Im *et al.*, 2008).

Many authors find the firm's external environment affects the relationship between entrepreneurial orientation and firm performance (Covin & Slevin, 1989, 1991; Covin & Covin, 1990; Lumpkin & Dess, 1996; Covin & Miles, 1999; Zahra *et al.*, 1999). Thus, entrepreneurial orientation appears to yield higher performance levels in turbulent, highly complex, dynamic and hostile environments, where survival is seen to depend on risk taking and pro-activeness (Mintzberg, 1973; Covin & Slevin, 1989).

On the subject of innovativeness, Girardi *et al.* (2005) suggests that innovating organizations search for opportunities, accept risks, pursue financial profits and organize resources, while, as a group, representing the possibilities for change in their societies. A clear consensus in the literature about the influence of the innovation indicates its relevance to economic performance in both organizations and countries (Paladino, 2008). This is due, among other reasons, to the fact that companies adopting innovativeness attitude are

better able to protect themselves in an unstable environment, respond rapidly to changes and find the capacity to discover and exploit new products and market options (Miles & Snow, 1978).

Some empirical studies confirm this relationship between innovativeness and performance, which a priori expectations suggest to be positive. Thus, Salavou & Avlonitis (2008) recommend the use of different performance models. Furtan & Sauer (2008) find no clear relationship between innovation and added value, and Calantone *et al.* (2002) specify that learning is what conditions innovation, but innovation and performance are not necessarily directly related.

The line of reasoning adopted in this study for the analysis of the impact of these three approaches on firm performance, using not only profitability measures but also efficiency indices, which provide a better picture of the use of resources. The advantage of this approach is that a profitability ratio, such as ROA, compares only two magnitudes, while an efficiency index synthesizes the balance between several outputs and several inputs to form a single value. Thus, by taking both into account, there is a gain in objectivity and proximity to business reality is not lost.

The only study to consider the influence of market orientation on ROA profitability and a nonparametric efficiency measure is that of Haugland *et al.* (2007) which focuses on the hotel industry, finding effects in both these performance areas. The analysis presented in this paper focuses on the agro-food industry, using different techniques for the estimation of the various models, specifically, quantile regressions for profitability indices and truncated regressions for the efficiency scores.

Methods

In-person interview design and the sample

To provide empirical evidence for the proposed objectives, this research concentrates on agro-food companies in the Ebro Valley, in Spain. Two main reasons explain this choice of business sector. One is its economic relevance in the study area, where the sector accounts for the second largest share in regional gross domestic product (GDP) for the three autonomous communities involved (Aragon, Navarra and La Rioja). The other is the need to contribute to industry-level research. In this respect, the analysis of the proposed objectives in

a single business sector increases the homogeneity of the results and their pertinence to the variables of interest (Gellynk *et al.*, 2007). Only firms with more than five workers were selected from the total population in order to exclude microenterprises, since many hardly qualify as agro-industries and their inclusion might hamper proper comparison.

Data supplied by the Departments of Agriculture of the various autonomous communities of Spain and the SABI (Iberian —Spain and Portugal— balance sheet analysis system) enables the identification of 586 firms in the sector in question. All received a structured questionnaire addressed to the company director or manager and returns were monitored. The postal interview to company manager, conducted between April and October 2007, resulted in 84 valid responses (about a 13% response rate).

The survey uses a five-part questionnaire. Part 1, directed at the chief executive officer (CEO), provides a general description of the organization in terms of size, activity volume, main products and markets, legal form and ownership structure. Parts 2 and 3 collect data concerning the firm's main suppliers and customers and its strategic action options. Part 4 measures the extent of the firm's market, entrepreneurial orientation and innovativeness. The fifth and last part includes the firm's main economic data in order to assess its scores on the main performance indicators.

Table 1 compares the mean economic indicator values for the sample and the study population, based on data from the survey and the SABI database. Although the comparatively lower average income and firm performance values of the sample firms show them to

be smaller on average than the population as a whole, their business activity and profit margins are higher. The variability of any of these indicators, as measured by standard deviations, shows that the sample values fall within the confidence interval of the whole population.

Market orientation, entrepreneurial orientation and innovativeness measures

Market orientation

The MKTOR (Narver & Slater, 1990) and MARKOR (Kumar *et al.*, 1998) measuring scales are the most suitable to assess the degree to which a firm, or even a strategic business unit, is oriented towards the market (Oczkowski & Farrell, 1997; among others). In this case, market orientation is measured on a 30-item MARKOR scale (Narver & Slater, 1990), which resulted to be valid following various reliability and validity tests and the necessary refinement, as will be described later together with the rest of the scales employed. Suppl. Table 1 (pdf) shows the full scale, which consists of three dimensions: customer orientation, competence orientation and inter-functional coordination¹, as has been previously mentioned.

Entrepreneurial orientation

Entrepreneurial orientation, measured on a scale based on Covin & Slevin (1989, 1991), comprises nine items

Table 1. Economic indicators for the sample population and research sample in the Mid Ebro Valley

	Sample			Population		
	N	Mean	SD	N	Mean	SD
Operating income (× €1,000)	84	7,758.5	13.77	586	9,778	18,380
Ordinary profit before tax (× €1,000)	84	195.2	726.81	586	280	2,224
ROI (%)	84	1.2	42.45	581	3.6	52.97
ROA (%)	84	2.4	7.27	586	2.0	9.42
Profit margin (%)	84	2.0	6.54	586	0.2	21.15

ROI: return on investment. ROA: return on assets.

¹ We conducted two discriminant validity tests to check whether the concept defined by the scale is sufficiently distinct from other related concepts (Lehmann *et al.*, 1999). The first was Anderson & Gerbing's (1988) procedure, which estimates the confidence intervals for the estimated correlation coefficients between pairs of dimensions and checks that they do not contain unity (Hair *et al.*, 1998). The second, described by Berné *et al.* (1996), demonstrates discriminant validity when the Cronbach's alpha of each scale is higher than any of the correlations between that scale and the rest. Both tests supported discriminant validity.

designed to capture the firm's tendency towards innovation, risk taking capacity and pro-activeness [Suppl. Table 1 (pdf)]. All three of which are described as the sub-dimensions of the entrepreneurial orientation concept (Miller, 1983), as noted in the previous section. Numerous empirical studies use and test these measures.

Innovativeness

In light of evidence showing the increasing impact of innovation on competitiveness, the location of microeconomic R&D and innovation data sources becomes essential. Innovation surveys, based on a broad range of starting variables, have emerged as an ideal tool for gathering large amounts of information, which, after data-coding and aggregation, yield synthetic indicators of the impact of innovation on firms. The

innovation concept can be measured using objective technological indicators or simply scales developed and refined for the purpose.

The present study requires a measure that is homogeneous with the rest of the indicators, and therefore uses a seven-item scale based on one devised by Huiban & Boushina (1998) and already used in various sectors including the agro-food industry. Supplementary Table 1 (pdf) shows the full scale. It comprises seven items exploring issues such as product and market launch strategies, employee training, organizational learning and conflict solving.

Scale validation process

Table 2 presents the psychometric scores obtained on each of the scales used (market, entrepreneurial

Table 2. Validity scale: reliability, dimensionality, convergent validity and discriminant validity

	Variables	Market orientation	Innovativeness	Entrepreneurial orientation	
Reliability test	Cronbach's α	0.90	0.85	0.79	
	Item-total correlation	>3	>3	>3	
Dimensionality tests	Matrix determinant value	0.00	0.07	0.07	
	KMO correlation	0.87	0.84	0.69	
	Bartlett's sphericity test	χ^2	533.27	209.21	209.29
		df	78	15	21
	<i>p</i>	0.000	0.000	0.000	
Convergent validity	χ^2	112.73	12.66	54.67	
	df	62	9	14	
	χ^2/df	1.82	1.41	3.90	
	CFI	0.90	0.98	0.79	
	GFI	0.82	0.96	0.86	
	NFI	0.80	0.94	0.75	
	IFI	0.90	0.98	0.80	
	RMR	0.06	0.05	0.09	
	RMSEA	0.09	0.07	0.19	
	<i>p</i>	0.00	0.18	0.00	
Discriminant validity	Cov(error) (IC)	Market orientation			
		Innovativeness	—	—	
	Entrepreneurial orientation	Market orientation	0.22 (0.06)	—	
		Innovativeness	(0.10, 0.32)	0.41 (0.11)	
		(0.13, 0.43)	(0.20, 0.63)		

KMO: Kaiser-Meyer-Olkin test; CFI: confirmatory fit index; GFI: goodness of fit; NFI: normed fit index; IFI: incremental fit index; RMR: root-mean-square residual index; RMSEA: root-mean-square error of approximation; IC: interval confidence. Optimum value of the variables: Cronbach's α : > 0.7; Item-total correlation: > 3; KMO correlation: > 0.7; Degrees of freedom significance: < 0.001; χ^2/df : 0-5; CFI: > 0.90; GFI: > 0.90; NFI: > 0.90; IFI: > 0.90; IFI: > 0.90; RMR: < 0.10; RMSEA: < 0.08; *p* < 0.05. Discriminant validity: IC \notin 1.

orientation and innovativeness). First, scale-item reliability was tested with Cronbach's alpha (Cronbach, 1951) to assess the need to remove certain items. After refinement, all three scales were judged reliable, with all correlation coefficients amply exceeding 0.30 (Nunnally, 1978). The subscales of each construct were assessed to ensure their relative independence and internal consistency. All the sampling adequacy (KMO) scores are very close to 0.8, thus confirming all the exploratory factor analyses conducted (Kaiser, 1974). A test of convergent validity tries then to ensure that each scale captures suitably the corresponding concept. For this, the indicators should be correlated (Churchill, 1979) and the usual method is to check that the factor loadings are significant and exceed 0.5 (Anderson & Gerbing, 1988; Bagozzi & Yi, 1988; Hair *et al.*, 1998). All the indicators satisfied both these conditions and the chi-square and CFI, NFI, AGFI, IFI, RMR and RMSEA goodness of fit statistics were close to the optimum values. Finally, the discriminant validity was checked using the approach recommended by Anderson & Gerbing (1988), which is to estimate the confidence intervals for inter-construct correlations, with corresponding standard errors, to ensure that none of the intervals includes a value of 1. This was confirmed in all cases (Hair *et al.*, 1998; Luque, 2000). Suppl. Table 1 (pdf) shows the variables included in each scale after refinement.

Business achievement metrics and profitability and efficiency indices

Profitability indices

Literature review shows that does not exist an unique criterion for the selection of firm performance indicators. This study uses ROA together with the efficiency indicators presented below. The financial performance indicator, ROA, enables assessment of the firm's ability to capture demand, and generate added value from its use of resources. Data supplied by the firms plus data drawn from the SABI database was used to obtain the estimates.

Non-parametric methods

DEA is a more complete method than profitability ratios, because it computes an efficiency index that

compares the firm's combination of inputs used with its output. Mathematical programming techniques determine the efficiency of each firm in terms of the distance from the production frontier given by a set of technologically homogeneous firms. In other words, each firm's performance gives a relative position against that of the best performers. The latter make up the efficient production frontier. Running a separate DEA model by linear programming for every firm i enables estimation of firm i 's efficiency compared to all the rest. The input-oriented DEA model takes the following form (CCR model, Charnes *et al.*, 1978):

$$e_i^{crs} = \min_{\theta, \lambda} \theta$$

subject to:

$$\begin{aligned} \theta x_i - X\lambda &\geq 0 \\ -y_i + Y\lambda &\geq 0 \\ \lambda &\geq 0 \end{aligned} \quad [1]$$

where:

— x_i is a vector $J \times 1$ of factors of production used by firm i , and $X = (x_1, \dots, x_i, \dots, x_N)$ is a matrix containing the J factors of production used in the N firms. In this study, the inputs are fixed assets (K), number of workers (L), consumption of intermediates and raw materials (RM) and other operating costs (OOC). All this information was extracted from Commercial Registers provided by the SABI database.

— $y_i (1 \times 1)$, is the output obtained in firm i , and $Y = (y_1, \dots, y_i, \dots, y_N)$ is a vector containing the outputs from N firms. The output considered in this study is operating income.

— λ is an $N \times 1$ vector of variables that gives the maximum radial contraction of x_i within the feasible set of inputs and θ is a value between 0 and 1 that describes the efficiency of firm i .

The solution of CCR model [1] for every firm gives a value θ ; $\theta = 1$ means that the firm lies on the frontier and is therefore efficient, but $\theta < 1$ means that it is possible to contract the inputs and still obtain the same amount of outputs, which implies some level of inefficiency. The linear programming of model [1] satisfies the properties of constant returns to scale, free disposability of inputs and outputs, and convexity. The introduction of a restriction of the form,

$$u\lambda = 1 \quad [2]$$

where u is a $1 \times N$ vector of ones, provides an efficiency index under the less restrictive assumption of varying returns to scale (BCC model, Banker *et al.*, 1984). If the values of these two measures of efficiency, under

constant (CCR model) and varying returns to scale (BCC model), do not coincide, scale inefficiencies are present, the index of which is given by the quotient:

$$e_i^{es} = \frac{e_i^{crs}}{e_i^{vrs}} \quad [3]$$

Second-stage analysis

Having characterized all the firms, this methodology allows the researcher to proceed to a second stage of analysis, which focuses on the causes of management inefficiencies. For practical purposes, this procedure consists of the identification of the factors accounting for the variability in the efficiency indices. The techniques used for this include regression analysis, which assesses the joint effects of several external variables denoted by z (to distinguish them from the inputs, x , and outputs, y), by estimating an equation with the following specification:

$$e_i = z_i \beta + \varepsilon_i \quad [4]$$

where z_i is a $1 \times r$ vector to capture the external variables of firm i , β is a parameter vector and $\varepsilon_i \sim N(0, \sigma^2_\varepsilon)$ is an independent and identically distributed residual error term for all observations. The advantage of regression analysis is that the method identifies the marginal contribution of each explanatory variable, while ignoring the effects of the rest. Ordinary least squares estimates are inconsistent, given the efficiency score interval of $[0, 1]$. Censored Tobit regression overcomes this problem, which until recently has been the preferred option.

Nevertheless, Simar & Wilson (2007) are critical of second-stage analysis for three reasons: (i) no empirical research describes the data generating process underlying variables x , y , and z , to obtain consistency in the second-stage estimates; (ii) lack of a coherent rationale for censoring the dependent variable; (iii) DEA efficiency estimates show complicated, unknown

serial correlation, arising from the fact that, in finite samples, slight perturbations in the observations lying on the frontier distort the rest of the efficiency estimates. Simar & Wilson (2007)'s proposal solves these problems and permits consistent statistical inference in the second stage. The present study uses Algorithm 1 (Simar & Wilson, 2007) which improves the inference of the β parameter estimates while ignoring biases in the efficiency scores.

For a complementary analysis, Eq. [4] with the dependent variable being the ROA ratio serves to a deeper understanding of the relationships between business strategies and business achievements. Estimation by quantile regression (Koenker & Basset, 1978) presents some advantage since it models the effects of the independent variables on the whole distribution of the dependent variable. This procedure is appropriate in the case of complex relationships, such as when the influence of certain factors occurs only above a certain value of the dependent variable. This feature is undeniably useful when working with the data under consideration. The method is also robust to samples containing outliers, heteroscedasticity, interaction between factors and non-normal residual distributions.

Results and discussion

The estimation of these efficiency scores required the elimination of some observations due to missing data. This resulted in a final sample of 69 firms. These have been treated as a set of homogenous units due to the fact that they use cost and revenue data taken from accounting information and not physical units of inputs and outputs. This contributes to making comparisons possible between firms that are technically different but with reasonably similar accountancy results (Zelenyuk & Zhaka, 2006). Some basic input and output statistics appear in Table 3. The total income values (Y) range between €320,000 for the smallest and €81

Table 3. Basic input and output statistics

	Minimum	Percentile 25	Median	Mean	Percentile 75	Maximum	SD
Y ($\times \in 1,000$)	320.00	1,583.00	2,763.00	8,195.33	7,926.00	81,156.00	14,626.98
K ($\times \in 1,000$)	37.00	272.00	543.00	3,000.13	2,577.00	42,252.00	6,881.79
L (workers yr ⁻¹)	4.00	10.00	19.00	44.29	39.00	703.00	93.49
RM ($\times \in 1,000$)	86.00	897.00	1,736.00	5,233.81	4,907.00	48,316.00	9,028.86
OO ($\times \in 1,000$)	172.00	479.00	852.00	2,707.43	2,281.00	41,637.00	6,217.11

Y: operating income. K: fixed assets. L: number of workers. RM: raw materials. OOC: other operating costs.

Table 4. Coefficients of correlation among variables

	Y	K	L	RM	OOO	Ocl	Oco	Cif	Inn	Bdi	Pro_adr
Y	1.00										
K	0.77	1.00									
L	0.80	0.82	1.00								
RM	0.94	0.57	0.59	1.00							
OOO	0.90	0.89	0.94	0.72	1.00						
Ocl	0.30	0.08	0.19	0.35	0.19	1.00					
Oco	0.30	0.18	0.27	0.29	0.27	0.72	1.00				
Cif	0.14	0.15	0.09	0.12	0.14	0.57	0.60	1.00			
Inn	0.02	0.04	0.08	-0.01	0.06	0.45	0.42	0.47	1.00		
Bdi	0.26	0.14	0.24	0.25	0.23	0.51	0.55	0.33	0.43	1.00	
Pro_adr	-0.11	-0.09	-0.11	-0.10	-0.11	0.38	0.43	0.49	0.46	0.39	1.00

Y: operating income. K: fixed assets. L: number of workers. RM: raw materials. OOO: other operating costs. OM: market orientation scale factor. Ocl: customer orientation factor. Oco: competence orientation factor. Cif: interfunctional coordination factor. Inn: innovativeness. Bdi: innovation seeking factor. Pro_adr: risk aversion factor.

million for the largest, the average being €8.195 million. All the variables show high dispersion and a high level of right-skewness, as shown by the mean values, which are all much higher than the median values. This is because most of the firms belong to the small-to-medium size category, which leads to a concentration of these in the lower part of the distribution. Thus, of the total sample of 69 firms, 8 are micro-enterprises (*i.e.*, satisfy the three criteria of $Y < €2$ million, $L < 10$ workers, total assets $< €2$ million), 45 are small firms ($Y < €10$ million, $L < 50$ workers, total assets $< €10$ million), 13 are medium-sized ($Y < €50$ million, $L < 250$ workers, total assets $< €43$ million) and 3 are large. Table 4 shows the coefficients of correlation among all the study variables, both for the first and the second stage. They present different degrees of positive correlation.

Table 5 shows some statistics for the distributions of efficiency scores, e_i^{crs} , e_i^{vrs} , estimated for each firm by optimizing the CCR [1] and BCC model —[1] with the restriction [2]—, respectively, after entering the

output Y and the inputs K , L , RM and OOO . Table 5 also summarizes some basic statistics for scale efficiencies, e_i^s , computed from expression [3]. The mean efficiency score for the sample firms is quite high, 0.909 under constant returns to scale. This means that an average firm could improve its efficiency by reducing its inputs by nearly 9% to produce the same amount of output. For firm with the lowest efficiency ($e_i^{crs} = 0.652$), the input reduction potential is almost 35%.

The results are similar under variable returns to scale: e_i^{vrs} efficiency has a mean value of 0.934 and a minimum value of 0.663. The relative proximity between e_i^{crs} and e_i^{vrs} suggests that the majority of firms are without any major scale problems, as the values of the scale efficiency index, e_i^s , also reveal. Another finding is the high percentage of firms with values equal to one: 18.84% (constant returns) and 34.78% (variable returns).

Table 5 also includes the bias-adjusted efficiency scores, $e_{i_bc}^{crs}$ and $e_{i_bc}^{vrs}$, calculated by bootstrapping, as proposed by Simar & Wilson (1998), with 2000

Table 5. Basic statistics of the efficiency scores

	Minimum	Percentile 25	Median	Mean	Percentile 75	Maximum	SD
e_i^{crs}	0.65	0.86	0.92	0.91	0.98	1.00	0.08
$e_{i_bc}^{crs}$	0.62	0.84	0.89	0.87	0.92	0.95	0.07
e_i^{vrs}	0.66	0.90	0.94	0.93	1.00	1.00	0.07
$e_{i_bc}^{vrs}$	0.64	0.88	0.91	0.89	0.92	0.96	0.05
e_i^s	0.89	0.97	0.99	0.97	1.00	1.00	0.03

e_i denotes the efficiency estimate; the super indices *crs* and *vrs* denote constant (CCR model) and variable (BCC model) returns to scale, respectively, e_i^s denotes scale efficiency; the subindex *bc* denotes the bootstrap bias-corrected estimates (Simar & Wilson, 2007).

repetitions. Both the standard deviations and the bootstrap estimates of bias are lower than reported in other empirical studies. For example, Zelenyuk & Zheka (2006), who also use accounting data for inputs and outputs, obtain higher dispersions, and a strong presence of outliers. The higher efficiency scores that this study reports likely points to a higher homogeneity of production processes in the sample, which is made up entirely of agro-food companies, unlike the sample used by the cited authors, which contained 158 Ukrainian firms from sectors as diverse as chemicals, construction, engineering, metallurgy, services, transport and food. Similarly, the bootstrap estimates of bias (difference between efficiency and bias-adjusted efficiency) average 4.7% with a maximum value of 11.4%, well below those of Zelenyuk & Zheka (2006) who report mean biases of up to 30%.

Finally, Table 6 gives the results of the second-stage regressions, where the dependent variables are the efficiency estimates under constant returns to scale, (original and bias-corrected) and the relative profitability index, ROA. The explanatory variables are the market, innovation and entrepreneurial orientation factors, and sector dummy variables to capture differences in production processes. In both cases, the estimations are robust to variable skew, the presence of outliers and heteroscedasticity: for efficiency, truncated regression via maximum likelihood; for ROA, quantile regressions at various points in the upper part of the

joint distribution, as indicated earlier. Also in both cases, bootstrap repetitions, instead of asymptotic properties of the estimators, serve to obtain a more appropriate inference.

One of the most important findings emerging from the estimates is the positive relationship between the business achievement variables and the competition orientation factor, *Oco*. In the efficiency regressions, e_i^{crs} , $e_{i_bc}^{crs}$ and ROA, quantiles 0.75 and 0.90, the hypothesis that the coefficient will be different from zero is rejected at less than the 5% level of statistical significance, while in the median-based estimate of ROA, the critical p level reaches 7.1%. This finding is fairly robust and appears to suggest that the sample firms manage their resources with higher efficiency and higher profits when their capacity enables them to (i) acquire useful intelligence about competitors, (ii) make a rapid response to their rivals' actions, (iii) adjust to legal or technological changes and (iv) monitor market sensitivity and risk factors. Thus, the results show that, within the agro-food sector, particularly for SMES, it is also possible to find a relationship between market orientation tendencies in firms and better economic performance.

The other two market orientation factors, *Ocl* and *Cif*, lack statistical significance and even have negative signs, conclusions remaining unclear as to whether efficiency and profitability increase as a result of efforts to improve customer satisfaction actions or in-

Table 6. Efficiency and profitability regressed on market orientation, innovativeness and entrepreneurial orientation

Dependent variable	Truncated regression				Quantile regression					
	e_i^{crs}		$e_{i_bc}^{crs}$		ROA quantile 0.5		ROA quantile 0.75		ROA quantile 0.9	
	Coef	p	Coef	p	Coef	p	Coef	p	Coef	p
<i>Constant</i>	1.21***	0.00	0.90***	0.00	1.50	0.48	4.50**	0.05	8.52***	0.00
<i>Ocl</i>	-0.00	0.46	-0.00	0.38	-1.20	0.26	-0.64	0.67	-4.30*	0.10
<i>Oco</i>	0.06**	0.04	0.02**	0.03	1.90*	0.07	2.83**	0.04	5.06**	0.03
<i>Cif</i>	0.01	0.35	-0.00	0.47	-0.99	0.42	-1.84	0.28	-0.91	0.73
<i>Inn</i>	-0.02	0.25	-0.01	0.14	0.13	0.89	0.19	0.88	2.70	0.14
<i>Bdi</i>	-0.06**	0.02	-0.02**	0.04	-0.10	0.90	-0.81	0.52	-0.59	0.76
<i>Pro_Adr</i>	0.00	0.42	0.00	0.43	-0.26	0.75	0.19	0.88	-0.82	0.66
<i>Meat industry</i>	-0.22**	0.01	-0.02	0.25	0.04	0.99	-1.47	0.58	0.43	0.90
<i>Wine production</i>	-0.22**	0.03	-0.04*	0.10	1.80	0.55	2.06	0.73	6.78	0.37
<i>Fruit & Vegetables</i>	-0.23***	0.01	-0.03	0.16	-0.24	0.92	-1.78	0.60	-2.72	0.54
<i>Second transformation</i>	-0.20**	0.02	-0.03	0.12	-1.06	0.71	1.72	0.70	13.82	0.09

Ocl (customer orientation), *Oco* (competition orientation), *Cif* (interfunctional coordination) are the market orientation factors; *Inn* (innovativeness); *Bdi* (innovation seeking), *Pro_Adr* (pro-activeness and risk aversion), entrepreneurial orientation. *Meat industry*, *Wine production*, *Fruit & Vegetables* and *Second transformation* are the sector dummies. Asterisks denote that coefficients are significantly different from zero: <1% (***) , <5% (**) and <10% (*). The p -values were computed by bootstrap.

ternal co-ordination. The same applies to the innovativeness factor, *Inn*, and the pro-active, risk-averse entrepreneurial orientation factor, *Pro_adr*. That is not to say that clear efficiency or profitability gains are impossible via these approaches, simply that no such relationship is observed in the sample firms. Several perspectives offer a rationale for this innovation outcome. First, the firm's innovation efforts in a given year do not have economic consequences on that same year, but have a somewhat delayed effect, as suggested by Narver & Slater (1990), among others.

Other perspectives on the relationship between innovation and firm performance include the suggestion that it is not a direct relationship (Mavondo *et al.*, 2005, Simpson *et al.*, 2006; Furtan & Sauer, 2008). Put another way, market orientation is a good source of innovation (Bigné *et al.*, 2000), or even they have strong feedback links. Thus, a possible future extension of the research might be to revise the various forms of the relationships between these business strategies, as suggested by Hurley & Hult (1998).

The sector variables have significance only in the first of the regressions presented in Table 6. And the size variable (the log of total assets) included does not have any significant effect (results not shown). The results for the innovativeness-seeking factor, *Bdi*, which is a component of entrepreneurial orientation, are significant with a negative sign in both efficiency estimations, but not in the profitability regression. This factor captures the effort the firm makes to introduce new products and/or technological processes, which inevitably involve higher research and patenting costs, etc., but do not necessarily lead to revenue gains in the same financial year. Thus, the probable explanation is that the efficiency scores of more innovativeness-seeking firms fall as their costs increase and their income remains the same, without any substantial effect on their profitability. This raises the question whether these firms will improve their future positioning through their greater tendency to seek innovativeness.

These findings show some similarity with those of Haugland *et al.* (2007), despite their sample (101 Norwegian hotels) being completely different. Thus, as in the present study, these authors obtain no significant relationship between their 5-item customer orientation factor and their business achievement indicators. They only find a statistically significant positive relationship with the competition orientation factor (captured by prices relative to rivals).

Conclusions and limitations

With businesses frenetically changing the pace of their production processes and management infrastructure to adjust to the needs of new consumers, agro-food companies continually face strategic decisions in order to secure a place in the market. This search for sustainable competitive advantages is the starting point for the present study. It uses quantile and truncated regressions to assess the impact of market orientation, entrepreneurial orientation and innovativeness on the financial performance and efficiency of Spanish agro-food companies located in the Ebro Valley. The results of a survey conducted to these firms in 2007, pooled with information from the SABI database, provide the data for this study.

The study finds confirmation for the direct, positive and statistically significant impact of market orientation (particularly competition orientation) on profitability and efficiency performance, thus demonstrating the direct, positive relationship over the two variables. Therefore businesses should increase their efforts to obtain intelligence about their rivals, respond to their rivals' moves and adapt to technological change, because it will enable them to achieve performance gains.

Such immediate effects on firm performance were not found for entrepreneurial orientation and innovativeness, however. The observed values do not mean that extra effort in innovativeness or entrepreneurship will not result in performance improvements, they simply suggest that other underlying factors may be interacting. One of the main ones is that innovativeness efforts do not usually bring immediate results, since they tend to have mid to long-term outcomes. In addition, market orientation itself includes elements of innovation and a joint effect of the strategies under investigation, market orientation, entrepreneurial orientation and innovation, is also plausible. Therefore firms should be pro-active in market intelligence, innovativeness and entrepreneurship in order to improve their positioning.

In terms of its limitations, firstly, the study is cross-sectional and therefore fails to capture the long-term effects on firm performance produced by the type or level of orientation currently adopted by the firm. Secondly, since the sample only includes agro-food firms, the findings do not apply to other subsectors or geographical areas. Thus, more dynamic data analysis, testing of the proposed relationships in other sectors and the use of alternative models would serve to eva-

luate the direct or indirect relationships that may exist between these three strategies and firm performance. They might also serve to capture the complementary or excluding effects of these activities. The joint consideration of other practices and behavioral and attitudinal assessments would also be useful, given the increasing complexity of the competitive landscape for Spanish firms in general and certain sectors in particular. This is the case of the agro-food industry, which sometimes finds itself more subject than others to certain types of public intervention or regulation at national as well as international level.

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