

## The impact of the sector of activity and of the region of operation on the competitiveness of the Spanish Agri-Food Industry: a Shift-Share analysis

### El impacto del sector de actividad y de la región de actuación sobre la competitividad de la industria agroalimentar española: un análisis Shift-Share

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#### **ABSTRACT**

This paper evaluates the potential impact on the competitiveness of the Spanish Agri-Food Industry (AFI) of the economic strength of the two most important territorial factors that impact its development, namely the sector(s) of activity and the region(s) of operation within which each AFI enterprise operates. The importance of studying such topic centers on a two-part rationale, namely (i) the central role played by competitiveness in the survival, growth and profitability of any firm; and (ii) the pivotal position of the AFI within the manufacturing sector, as well as its proximity to the agricultural sector of the economy. The method of analysis adopted for these purposes is based upon the concepts of  $\alpha$  and  $\beta$  convergence and upon shift-share analysis. As a final conclusion, it may be stated that the territorial development of the AFI does not tend to converge. Hence, it is necessary to study the specific regional and sectorial strategies that have been developed to carry out the competitive position of the AFI.

**Keywords:** Competitiveness, shift-share analysis, convergence, Agri-Food Industry

#### **RESUMEN**

En este trabajo se evalúa el impacto potencial en la competitividad de la Industria Agroalimentaria (IAE) española, de la fortaleza económica de los dos factores territoriales más importantes que inciden en su desarrollo, a saber, los sectores de actividad y la región de operación dentro de la cual opera cada empresa. La importancia de estudiar este tema se centra en una lógica de dos partes, a saber (i) el papel central que juega la competitividad en la supervivencia, el crecimiento y la rentabilidad de cualquier empresa; y (ii) la posición central de la IAE dentro del sector manufacturero, así como su proximidad al sector agrícola de

la economía. El método de análisis adoptado para estos propósitos se basa en los conceptos de convergencia  $\alpha$  y  $\beta$  y en el análisis de cambio-participación. Como conclusión final, se puede afirmar que el desarrollo territorial de la IAE no tiende a converger. De ahí que sea necesario estudiar las estrategias regionales y sectoriales específicas que se han desarrollado para llevar a cabo la posición competitiva de la IAE.

**Palavras Clave:** competitividad, análisis *shift-share*, convergencia, industria agroalimentar

## 1 INTRODUCTION

The primary purpose of this paper is to evaluate the potential impact on the competitiveness of the Spanish Agri-Food Industry (AFI) of the economic strength of the two most important territorial factors that impact its development, namely the sector(s) of activity and the region(s) of operation within which each AFI enterprise operates. The importance of studying such topic centers on a two-part rationale, namely (i) the central role played by competitiveness in the survival, growth and profitability of any firm; and (ii) the pivotal position of the AFI within the manufacturing sector, as well as its proximity to the agricultural sector of the economy.

With respect to the first part, observe that the degree of competitiveness of a firm is one of the main determinants of its market survival (e.g. Carraresi and Banterle, 2015; European Commission, 2009; Latruffe, 2010; Mamaqui et al., 2009), without which it is likely to cease to exist (e.g. Krugman, 1994). Furthermore, observe the fact that the individual firms themselves are primarily responsible for the development and improvement of their own competitive strength in any market, be it global or local (e.g. Silva, 2003). In turn, such degree of specificity implies the need to develop unique policies, adjusted to the characteristics of each location in which the firm operates, so as to extract the endogenous economic advantages that enhance its competitiveness position (e.g. Silva, 2003). The goal is to increase the degree of competitiveness to the point of allowing the firm to generate its products in the most efficient manner (i.e. at the minimum cost) and with the highest possible quality (e.g. Fischer et al., 2009; Schiefer and Hartmann, 2008).

These ideas highlight the existence of a valuable connection between the region and the sector of activity of the competitiveness of the Spanish agri-food industry. In fact, researchers have claimed the importance of linking the territorial factors with the firm competitiveness for many years (see, for exemple Latruffe, 2010). In light the gap on the literature, our aim in this paper is to analyse the relationship between the region, the sector of activity and the firm performance.

The reminder of this paper is organized as follows. Section 2 literature review and statements of hypothesis. Section 3 includes the methodological basis of the paper. It describes the variables used to measure the various elements of competitiveness (section 3.1), the nature of the database used to test the hypotheses (section 3.2) and the method of analysis adopted for these purposes, based upon the concepts of  $\alpha$  and  $\beta$  convergence (section 3.3) and a version of shift-share analysis (section 3.4). Section 4 presents

the empirical results and their implications. A Concluding Comments section completes the paper.

## 2 LITERATURE REVIEW AND STATEMENTS OF HYPOTHESIS

This section is divided into three parts. The first is identified with the factors that cast some doubts as to the degree of competitiveness of the Spanish Agri-Food Industry. The other two summarize the literature on the role played by the region and the sector where each AFI operates in resolving these doubts and provide the statement and the rationale for the two basic hypotheses tested in this paper.

### 2.1 NEGATIVE IMPACTS ON THE DEGREE OF COMPETITIVENESS

Even if, as stated in the Introduction, the relevance of the agri-food industry within Europe strives primarily on its leadership in the generation of value added and employment, there are some factors that may exert substantially negative pressure of the degree of competitiveness of the Agri-Food sector (e.g. Schiefer and Hartmann, 2008; Wijnands et al, 2008). Furthermore, the Spanish AFI, while being the country's principal manufacturing sector (e.g. INE, 2015), is also located within a very highly competitive market.

These negative factors may be classified into three categories. The first relates to the *structural adjustments* the AFI sector is experiencing at the present time, due to some recent supply and demand changes that have enhanced the impact of these negative effects (e.g. Boehlje et al., 2011; European Commission, 2009). On the demand side, we refer, due to some shifts in consumer preferences (e.g. Angulo et al., 2007; Donald and Bay-Palmer, 2006; Fayos et al., 2009; Gracia and Albisu, 2004), due to "income and lifestyle developments as well as shifts in population structures and lifestyles" (e.g. European Commission, 2009, p.5), that have led many firms to be located nearer the consumption centers of the final AFI products. Supply side considerations are related to the increase in production costs, arising from the AFI being the most strictly regulated sector of the EU and the Spanish economies (e.g. Dimara et al, 2008), due to growing concerns with respect to food safety, health, consumer information and the functioning of the internal EU market (e.g. Carraresi and Banterle, 2015; European Commission, 2009; Wijnands et al., 2008).

The second category deals with such *globalization-related issues*, as (e.g. Schiefer and Hartmann, 2008, Bojnec and Fertö, 2015) (i) the technological innovations that allow perishable goods to be transported across larger distances; (ii) the rapidly banishing trade barriers that is leading to the liberalization of old agricultural markets and the opening of new ones (e.g. Olper et al., 2014; Wijnands et al., 2008); (iii) the enlargement of the EU (e.g. Albisu and Gracia, 2002); and (iv) the 2007 EU economic crisis (e.g. Carraresi and Banterle, 2015).

The third category is related to the highly skewed *size distribution* of the AFI firms. Our size classification scheme follows that proposed by the European Union in EU (2006). As such, the defining

measurement criteria for a given year include the number of workers ( $W$ ), the total assets ( $A$ ) and the total sales ( $S$ ). According to such scheme, each AFI firm belongs to one of the following categories: Micro (with  $W < 10$  workers,  $A < \$2$  million and  $S < \$2$  million); Small (with  $10 < W < 50$  workers,  $\$2$  million  $< A < \$10$  million and  $\$2$  million  $< S < \$10$  million); Medium (with  $50 \leq W < 250$  workers,  $\$10$  million  $\leq A < \$43$  million and  $\$10$  million  $\leq S < \$53$  million); and Big (with  $W \geq 250$  workers,  $A \geq \$43$  million and  $S \geq \$53$  million).

The Spanish Agri-Food Industry size distribution is consistent with the average of the firms in EU (e.g. Hirsch and Gschwandtner, 2013). It is characterized by two important features. The first relates to the high degree of atomization (e.g. Fayos et al., 2009) present in the data, since the AFI size distribution consists of approximately 82% of the firms being micro in size; 14%, small; 3%, medium; and slightly less than 1%, large. The second relates to the substantial decrease in the number of AFI firms that took place after Spain's entry in the Eurozone in 2003 and especially after the economic crisis of 2007. This brings forward new calls for the rise in the size of the average AFI firm (e.g. Evans, 1987a, 1987b), even if at least part of the number decrease may be attributable to a modernization process, that leads to rises in the degree of competitiveness existing in the AFI sector, together with an increase in the productive scale of the firms within its midst (e.g. Gracia and Albisu, 2004). As a result, such peculiar size distribution may create important and serious problems when attempting to determine the degree of competitiveness in the AFI industry (e.g. Segarra-Blasco and Teruel-Carrizosa, 2012).

This policy development process identifies an additional competitive disadvantage for the smaller AFI firms, namely that business size is positively related to the exploitation of R&D returns and of innovative activities in general (e.g. L  pple, 2015). In fact, low levels of labour productivity reflect the underlying problem of insufficient R&D investment (e.g. European Commission, 2009).

## 2.2 THE ROLE OF THE AGRI-FOOD FIRM'S OPERATING REGION(S) ON ITS COMPETITIVENESS

The geographical location of its firms impacts the competitiveness of the Agri-Food industry is embedded in the definition of competitiveness of Chavarr  a et al (2002). For this authors, the competitiveness is a comparative concept based upon the dynamic capability of the AFI firm, specifically located to improve, maintain and enhance, in a continuous and sustainable fashion, its participation in the market, be it local or international, through the production, distribution and sale of goods and services in the time, location and form demanded. In fact, the geographical, environmental and cultural characteristics of the region(s) where the AFI enterprises locate may be often as relevant as their operational advantages, in generating substantial differences in the size, profitability and growth of the firms in their midst. Further, geographical location may also be relevant (i) in explaining regional sector growth (e.g. M  rquez et al., 2009) and/or the development of local economic systems (e.g. Donald and Blay-Palmer, 2006; Pingali, 2007); and (ii) in defining the nature of the productive orientation of a specific region, usually based upon

local externalities, such as the closeness to consumer centres or to raw-materials producers, as it often happens with high-fixed-cost industries (e.g. Alfranca and Juárez, 2008). Other territorial competitiveness factors that may be embedded in this process include the expansion of metropolitan areas and/or of communication networks (e.g. Trullén et al., 2004).

Finally, there is another factor of great importance among the agri-food firms that has a negative effect on their localization economies and is associated with the socio-economic changes the regions have experience in the last few years.

The regional structure of the Spanish AFI is summarized in Table 1, using the modified NUTS characterization (Albino, 2012). The largest firm concentrations occur in the South (ES6) and Centre (ES4) regions, with the mid-sized locations concentrated in the North-west (ES2), Cataluña (ES51), North-East (ES1) and Valencia (ES52) and, at the bottom, the Isles (ES7) and Madrid (ES3). The economic crisis at the end of 2007 resulted in a decrease of approximately 10% in the number of firms at each location, whereas the UE expansion of 2003 caused firm increases in the North-West (ES1), Center (ES4) and Isles (ES7) regions, whereas the remainder suffered decreases.

Table 1 – Regional structure of the Agri-Food Industry

REGION / YEAR	1999	2003	2007	2014
Asturias, Principado de	541	759	740	636
Cantabria	415	408	410	388
Galicia	2,695	2,732	2,586	2,291
ES1 – North-West	3,651	3,899	3,736	3,315
Aragón	1,258	1,157	1,096	997
Navarra	774	693	693	633
País Vasco	1,755	1,687	1,585	1,421
La Rioja	958	909	805	740
ES2 - North-East	4,745	4,446	4,179	3,791
Madrid	1,725	1,632	1,594	1,474
ES3 - Madrid	1,725	1,632	1,594	1,474
Castilla y León	3,3	3,329	3,267	3,013
Castilla La Mancha	2,942	2,797	2,625	2,347
Extremadura	1,338	1,587	1,557	1,346
ES4 - Centre	7,58	7,713	7,449	6,706
Cataluña	4,154	3,967	3,632	3,395
ES51 - Cataluña	4,154	3,967	3,632	3,395
Comunidad Valenciana	2,574	2,47	2,215	1,988
ES52 - Valencia	2,574	2,47	2,215	1,988
Andalucía	6,358	6,149	5,809	5,201
Murcia	1,297	1,178	1,186	1,033
ES6 - South	7,655	7,327	6,995	6,234
Baleares	613	605	551	482
Canarias	1,171	1,216	1,141	958
ES7 - Isles	1,784	1,821	1,692	1,44
<b>TOTAL</b>	<b>33,868</b>	<b>33,275</b>	<b>31,492</b>	<b>28,343</b>

Source: INE (various years). Instituto Nacional de Estadística

This brief literature review suggests that the localization factor enjoys a substantial influence on the competitiveness of the AFI firms. However, it also presents some evidence that this effect decreases in importance overtime, since the more underdeveloped regions tend to grow faster than the rich ones. Such regional growth convergence, together with the initial growth divergence, leads to the following hypothesis:

*H1: The region where the agri-food firm is located provides significant competitive advantages that tend to decrease overtime.*

### 2.3 THE ROLE OF THE AGRI-FOOD FIRM'S SECTOR OF OPERATIONS ON ITS COMPETITIVENESS

The European agri-food industry exhibits rather equitable competitive levels among its activity sectors, Hence, consistent movements above or below the mean seldom occur, even though the value ranges of the competitive levels of the agri-food countries have widened since the entrance of Eastern European countries into the European Community (e.g. Albisu and Gracia, 2002; Fischer and Schonberg, 2007a). Nevertheless, the sector of activity does impact on the degree of competitiveness of the agri-food firms, both in its external (its environmental, political, legal, institutional, cultural and demographic characteristics) and internal (infrastructure and technological basis) features (e.g. Dimara et al., 2008; Wijnands et al., 2008). Further, firms of a given sector tend to share characteristics that do condition their degree of competitiveness (e.g. Chavarría et al., 2002; Guerediaga, 2012).

The activity sector of the agri-food firms has a great impact in the level of innovation of the industry, due to its ability to accumulate knowledge (e.g. Cáceres and Camuñez, 2008). Finally, one of the main reasons why such competitiveness improvement has been sustained consists of an increase in agri-food industry exports that reached 24,018 million euros in 2014 or an increase from 2013 of 6%. At the same time, the number of exporting firms has grown at an average yearly rate of 5.3%, for a total of 55%, over the 2007-2014 time period.

In summary, these data allows us to claim that the agri-food industry is acting like one of the main the growth stars of the Spanish manufacturing industry, as well as consolidating an excellent competitive position within the EU. Such evidence leads to following hypothesis:

*H2: The competitiveness among the Agri-Food activity sectors exhibit substantial differences that tend to decrease overtime.*

### 3 METHODOLOGY

This section is divided into four parts. The first introduces the three accounting variables used to measure competitiveness. The second summarizes the nature of the database employed in the testing of the hypotheses identified in the previous section, with Albino (2012) presenting a more extensive description of this database. The last two sections introduce the theoretical basis of the testing procedure, namely the



concepts of  $\sigma$  and  $\beta$  convergence and the Arcelus (1984) version of shift-share analysis.

### 3.1 THE THREE ACCOUNTING VARIABLES USED TO MEASURE COMPETITIVENESS

Our analysis of the impact of the region and sector(s) of activity on the competitiveness of the agri-food industry is centered upon the evaluation of three accounting variables, namely Value added (*VA*), Earnings before interests, taxes, depreciation and amortization (*EBITDA*) and Earnings before interest and taxes (*EBIT*), also denoted as operating income (e.g. Booth and Cleary 2013). In this subsection, we present the nature of these variables, the rationale for their selection and the relationship between them. Following Fischer and Schornberg (2007a), we use the growth rates of these measures in the comparison exercises, as the most appropriate tool to capture the dynamic aspects of competitiveness, especially in intersectorial comparisons.

*Value Added (VA)* is defined (e.g. Fischer and Schornberg, 2007b) as the value of production in the period considered, excluding the purchases of input goods and services, i.e. minus the value of the raw materials and supplies consumed in the production process. It represents the wealth created by the firm during the period (e.g. Pérez-Carballo et al., 2004) and also the firm's contribution to the nation's Gross Domestic Product. As a result, besides indicating the suitability of the firm's activities to the structural characteristics of its market and sector of activity (e.g. Garrido, 2002; Haezendonck et al., 2006; Timmer and Vries, 2009).

*Earnings before interest, taxes, depreciation and amortization (EBITDA)* deducts labour expenses from *VA*, but not the expenses associated with the firm's responsibility towards the government nor those involved in the acquisition of fixed assets (e.g. Pérez-Carballo et al., 2004). As such, *EBITDA* represents the firm's potential to generate cash from operations (e.g. Archel et al., 2012; Tacke et al., 2009).

*Earnings before interest and taxes (EBIT)* measures the economic results of the firm before deducting interests and taxes, i.e. independently of how the firm's operations are financed (e.g. Archel et al., 2012). Hence, it is computed as *EBITDA* minus the depreciation and amortization expenses (e.g. Pérez-Carballo et al., 2004).

The use of *EBITDA* and *EBIT* complements that of *VA* as a competitiveness measure, since it renders feasible the assessment of the relative importance of labour and capital as productive factors. The difference between *VA* and *EBITDA* provide an indication as to the degree of labour intensity in a given firm, whereas a comparison between *EBITDA* and *EBIT* evaluates its degree of technological orientation. This is a crucial element of studies of this type, given the high degree of specialization of some sectors and/or regions in firms of either category.

### 3.2 THE DATABASE

Our database consists of the accounting and financial records of agri-food firms filed during the

2003-2011 time period, as they appear recorded in the SABI (Sistema de Análisis de Balances Ibéricos) system (<http://www.bvdep.com/SABI.html>). The coverage includes all firms in the Food and Drink industries (i.e. with codes 10 y 11, respectively) of Spain's National Registry of Economic Activities ([http://www.ine.es/inebmenu/mnu\\_clasifica.htm](http://www.ine.es/inebmenu/mnu_clasifica.htm)). The resulting database has been homogenized (e.g. ch. 2 of Albino, 2012) to render the information comparable across agri-food firms and throughout the years.

Table 2 provides the size distribution of firms in our database for the year 2011. The results clearly underscores the high degree of atomization existing in the Spanish agri-food industry size distribution, with about 71% of the firms in the *Micro* category and with only slightly over 2% being classified as *Big*.

Table 2- Number of firms in the Database by Size, Region and Sector for 2011

YEAR 2011	MICRO	SMALL	MEDIUM	BIG SIZE	TOTAL
Noroeste (ES1)	1.026	206	74	24	1.330
Noreste (ES2)	988	382	141	54	1.565
Madrid (ES3)	429	145	63	15	652
Centro (ES4)	1.846	611	181	47	2.685
Este Cataluña (ES51)	1.361	358	138	57	1.914
Este Val (ES52)	816	173	60	26	1.075
Sur (ES6)	1.765	426	137	39	2.367
Islas (ES7)	388	84	24	7	503
<b>TOTAL</b>	<b>8.619</b>	<b>2.385</b>	<b>818</b>	<b>269</b>	<b>12.091</b>
<b>TOTAL %</b>	<b>71%</b>	<b>20%</b>	<b>7%</b>	<b>2%</b>	<b>100%</b>
101 Meat	1.332	528	149	34	2.043
102 Fish	165	113	35	14	327
103 Fruit&Veg	328	125	83	33	569
104 OilFat	340	165	54	15	574
105 Milk	443	97	38	16	594
106 Grain	156	52	25	9	242
107 Farin	3.076	224	55	25	3.380
108 Others	1.136	316	110	38	1.600
109 AnFeed	221	148	61	11	441
110 Alcohol	1.367	577	183	58	2.185
111 NonAlcohol	55	40	25	16	136

Source: Own elaboration

The minimum database simple size for year  $t$ ,  $n_t$ , may be calculated on the basis of the population database (e.g. Grande and Abascal, 2014). As an example, for 2011, with a population size of  $N_{2011}=29,344$  enterprises, a confidence level of 2.58, an  $e_{2011}=.01$  and a maximum variance, associated with  $p_{2011}=q_{2011}=.5$ , of  $p_{2011} * q_{2011}=0.25$ , we obtain a minimum sample size of  $n_{2011}=10,385$  firms, whereas the SABI database includes 12,091 enterprises, which represents approximately 41% of the population.

### 3.3 THE B AND $\Sigma$ CONVERGENCE CONCEPTS

A crucial property of neoclassical economics is the concept of  $\beta$  convergence that relates to poor regions growing faster than rich ones. Hence, the poor region tends to catch up with the rich one in terms of the variables analyzed in this paper, namely *VA*, *EBITDA* and *EBIT*. The second, called  $\sigma$  convergence,



involves a decline over time in the cross-sectional dispersion of these variables. In addition, the existence of  $\beta$  convergence is a necessary condition for the existence of  $\sigma$  convergence, but not vice versa (e.g. Barro and Sala-i-Martin, 2004; Sala-i-Martin, 1996).

To estimate  $\sigma$  convergence, we use the standard index, namely the standard deviation,  $\sigma_\tau$ , of the log of each of the variables,  $S = VA, EBITDA, EBIT$ , for each year,  $\tau$ , across the  $N=8$  NUTS regions of Spain (i.e. Reig, 2007), i.e.

$$\sigma_\tau = \sqrt{\frac{\sum_{i=1}^N (\ln S_{i,\tau} - \ln S_\tau)^2}{N}} \quad (2)$$

Using (2), the concept of  $\sigma$  convergence, for the purpose of this paper, might be stated as follows (i.e. Sala-i-Martin, 1996): The NUTS regions of Spain are converging, in the sense of  $\sigma$ , if the dispersion of the variable used, either  $VA, EBITDA$  or  $EBIT$ , tends to decrease over time, i.e. if

$$\sigma_{t+T} < \sigma_t \quad (3)$$

For the estimation of  $\beta$  convergence, we use the standard neoclassical model (e.g. Sala-i-Martin, 1996) of

$$\frac{1}{T} \ln \frac{S_{i,t+T}}{S_{i,t}} = \alpha + \beta \ln S_{i,t} + \epsilon_{i,t} \quad (4)$$

where  $\alpha, \beta$  and  $\epsilon_{i,t}$  are, respectively, the intercept, the slope and the error term, with zero mean and constant variance and the rest of the terms are those defined for (2). Finally, if  $\beta < 0$ , then the regions of Spain are converging in the sense of  $\beta$ .

### 3.4 SHIFT-SHARE ANALYSIS

Shift-share analysis (SSA) is a standardization procedure, designed to decompose the change,  $\Delta S_{ij}$ , within two time periods, in the value of an index of economic growth ( $VA, EBITDA$  and  $EBIT$ , for the purposes of this paper), for sector  $i$  of region  $j$ , into several components, independently of the controversy surrounding its role as a forecasting tool or as a casual explanation of industrial growth changes (e.g. Arcelus, 1984, Barro and Sala-i-Martin, 2004). Table 3 contains the three formulations of interest for this paper, namely the traditional version (e.g. Dunn, 1960), and the revisions proposed by Esteban-Marquillas (1972) and Arcelus (1984) and the definitions of all variables used. Loveridge and Selting (1998), among others, evaluate the strengths and weaknesses of the various formulations and excellent reviews of the more recent SSA applications appear in Haynes and Parajuli (2015).

Table 3: The Shift-Share formulations

Effects (1)	Homothetic <sup>(2)</sup>	Residual	Total
National Growth, $N_{ij}$	$S_{ij}^* r_{00}$	$(S_{ij} - S_{ij}^*) r_{00}$	$S_{ij} r_{00}$
National Industry-Mix, $NI_{ij}$	$S_{ij}^* (r_{i0} - r_{00})$	$(S_{ij} - S_{ij}^*) (r_{i0} - r_{00})$	$S_{ij} (r_{i0} - r_{00})$
Regional Growth, $R_{ij}$	$S_{ij}^* (r_{0j} - r_{00})$	$(S_{ij} - S_{ij}^*) (r_{0j} - r_{00})$	$S_{ij} (r_{0j} - r_{00})$
Regional Industry-Mix, $RI_{ij}$	$S_{ij}^* [(r_{ij} - r_{i0}) - (r_{0j} - r_{00})]$	$(S_{ij} - S_{ij}^*) [(r_{ij} - r_{i0}) - (r_{0j} - r_{00})]$	$S_{ij} [(r_{ij} - r_{i0}) - (r_{0j} - r_{00})]$
Competition Effect, $C_{ij}$ $C_{ij} = R_{ij} + RI_{ij}$	$S_{ij}^* (r_{ij} - r_{i0})$	$(S_{ij} - S_{ij}^*) (r_{ij} - r_{i0})$	$S_{ij} (r_{ij} - r_{i0})$
<b>Total Effect, <math>D_{ij}</math></b>	<b><math>S_{ij}^* r_{ij}</math></b>	<b><math>(S_{ij} - S_{ij}^*) r_{ij}</math></b>	<b><math>S_{ij} r_{ij}</math></b>
$D_{ij} = N_{ij} + NI_{ij} + C_{ij} = N_{ij} + NI_{ij} + R_{ij} + RI_{ij}$			
(1) The Traditional shift-share formulation: $D_{ij} = S_{ij} r_{ij} = S_{ij} r_{00} + S_{ij} (r_{i0} - r_{00}) + S_{ij} (r_{0j} - r_{00}) + S_{ij} (r_{ij} - r_{i0})$			
The Esteban-Marquillas (1972) shift-share formulation:			
$D_{ij} = S_{ij} r_{ij} = S_{ij} r_{00} + S_{ij} (r_{i0} - r_{00}) + S_{ij}^* (r_{ij} - r_{i0}) + (S_{ij} - S_{ij}^*) (r_{ij} - r_{i0})$			
(2) The Arcelus (1984) shift-share formulation:			
$D_{ij} = S_{ij} r_{ij} = S_{ij}^* r_{00} + (S_{ij} - S_{ij}^*) r_{00} + S_{ij}^* (r_{i0} - r_{00}) + (S_{ij} - S_{ij}^*) (r_{i0} - r_{00}) + S_{ij}^* (r_{0j} - r_{00}) + (S_{ij} - S_{ij}^*) (r_{0j} - r_{00}) + S_{ij}^* [(r_{ij} - r_{i0}) - (r_{0j} - r_{00})] + (S_{ij} - S_{ij}^*) [(r_{ij} - r_{i0}) - (r_{0j} - r_{00})]$ where			
$r_{ij}$ = percentage change in the variable of interest in sector $i$ , region $j$			
$r_{i0}$ = percentage change in the variable of interest in sector $i$			
$r_{0j}$ = percentage change in the variable of interest in region $j$			
$r_{00}$ = percentage change in the variable of interest in the nation			
(2) The Homothetic employment, $S_{ij}^*$ , is defined as follows:			
$S_{ij}^* = S_{0j} S_{i0} / S_{00}$ ; $S_{i0} = \sum_{j=1}^M S_{ij}$ ; $S_{0j} = \sum_{i=1}^N S_{ij}$ ; $S_{00} = \sum_{i=1}^N \sum_{j=1}^M S_{ij}$			

Source: Own elaboration based in Marquillas (1972) and Arcelus (1984)

As shown in Table 3, the traditional SSA model (e.g. Dunn, 1960) decomposes the regional growth of sector  $i$  in region  $j$ , for a given period of time,  $\Delta S_{ij}$ , into three growth components, namely (i) the *National Growth*,  $N_{ij}$ , that part of  $\Delta S_{ij}$  attributable to the growth rate of the sector  $i$  in region  $j$  being the same as that of the nation; (ii) the *National Industry Mix*,  $NI_{ij}$ , that part of  $\Delta S_{ij}$  attributable to the positive or negative effects of the specialization of the regional employment (or any other variable of interest, like *VA*, *EBITDA* or *EBIT*, for this paper) in sectors where the rate of growth at the national level,  $r_{i0}$ , exceeds or is below the national growth rate,  $r_{00}$ ; and (iii) the *Competition Effect*,  $C_{ij}$ , measures the contribution to growth due to  $(r_{ij} - r_{i0})$ , i.e. to the special dynamism of sector  $i$  in region  $j$  as compared to the average growth of such sector at the national level. The sum of these three effects equals the actual change in the variable of interest for sector  $i$  within region  $j$ , during a given period of time.

In this paper, we make four basic modifications to the traditional model, all included in Arcelus (1984). First, we study the “change in the variable of interest” in yearly steps to take into consideration short-term fluctuations in the variable of interest and henceforth bringing the SSA formulation in line with the temporal aggregation issue handled by the dynamic SSA (e.g. Herath et al., 2011, 2013; Shi and Yang, 2008) approach. Second, we also include the allocation effect of Esteban-Marquillas (1972), through the inclusion of the Homothetic employment and designed to disentangle the impacts of the Competition Effect and of the National Industry-Mix effect (e.g. Loveridge and Selting, 1998). Third, we break the Competition Effect into two components, the Regional Growth,  $R_{ij}$  and the Regional Industry-Mix effects,

$RI_{ij}$ . The roles of  $R_{ij}$  and  $RI_{ij}$  are similar to those of the National Growth and the National Industry-Mix components, but intended to measure the impact of regional, rather than national, linkages (e.g. Arcelus, 1984) and hence provide a measure, albeit rather crude, of role of the regional and national markets on the change of  $\Delta S_{ij}$ . Fourth, as indicated in Table 3, we divide all four factors into a Homothetic and a residual component. The first is considered an “expected” component, intended to measure the impact of the dynamism of the national growth ( $r_{00}$ ), of the sector at the national level ( $r_{i0}-r_{00}$ ), of the region ( $r_{0j}-r_{00}$ ) and of the sector at the regional level,  $[(r_{ij}-r_{i0})-(r_{0j}-r_{00})]$ , at the Homothetic value of the variable of interest, i.e. at  $S_{ij}^*$ . The second measures the impact of the degree of specialization of region  $j$  in sector  $i$ ,  $(S_{ij}-S_{ij}^*)$ , on each of the four factors.

#### 4 EMPIRICAL RESULTS

This section summarizes the empirical results related to  $\sigma$ - and  $\beta$ -convergence (section 4.1) and *shift-share analysis* (section 4.2), based on the methodology presented in the previous section.

##### 4.1 $\Sigma$ - AND B-CONVERGENCE RESULTS

As the results of Table 4 clearly show, our  $\sigma$ -convergence analysis indicates the nonexistence of such an effect, for the Spanish agri-food industry, during the sample years studied. For these purposes, we have carried out the  $\sigma$ -convergence exercise for the two sub-periods, covering the pre and post the economic crisis of 2007. From these results, we can categorically state not only that there was no  $\sigma$ -convergence during the entire sample period, but that during the post 2007 time frame, the degree of dispersion increased, which provides further evidence of the economic divergence that occurred during this time period.

Table 4–  $\sigma$  Convergence

CONVERGENCE		VA_Ln	EBITDA_Ln	EBITI_Ln
		$\sigma$	$\sigma$	$\sigma$
YEAR	2004	1,50	1,75	2,04
	2005	1,52	1,77	2,08
	2006	1,54	1,78	2,09
	2007	1,57	1,81	2,07
	2008	1,57	1,84	2,12
	2009	1,60	1,90	2,19
	2010	1,64	1,94	2,20
	2011	1,68	1,98	2,25
	<b>2004-2011</b>	<b>1,58</b>	<b>1,85</b>	<b>2,13</b>
2004-2007	1,53	1,78	2,07	
2008-2011	1,62	1,91	2,19	
SECTOR	101 MEAT	1,48	1,69	1,98
	102 FISH	1,47	1,64	1,91
	103 FRVEG	1,69	1,85	2,15
	104 OILFAT	1,56	1,67	2,14
	105 MILK	1,70	1,89	2,15
	106 GRAIN	1,60	1,92	2,17
	107 FARIN	1,27	1,63	1,84
	108 OTHERS	1,66	1,87	2,15
	109 ANFEED	1,53	1,70	2,05
	110 ALCOH	1,81	1,88	2,25
	111 NONALC	2,07	2,25	2,64
REGION	ES1 Nord-West	1,60	1,91	2,14
	ES2 Nord-East	1,64	1,88	2,17
	ES3 Madrid	1,56	1,94	2,21
	ES4 Centre	1,54	1,78	2,07
	ES51 East- Cataluña	1,67	1,86	2,12
	ES52 East- Valencia	1,60	1,97	2,25
	ES6 South	1,47	1,80	2,03

Source: Own elaboration

In addition, when carrying similar type of analysis at the sectorial level, we observe that the farinaceous sector (107) exhibits the smallest  $\sigma$ -convergence factors, for the three performance measures *VA*, *EBITDA* and *EBIT* considered in this paper. Further, at the regional level, the South (ES6), for *VA* and *EBIT* and the Center (ES4), for *EBITDA*, perform a similar role, reflecting the high sectorial concentration existing in these two regions.

Considering these results, we cannot accept the convergence between the regions and sectors because the strategies developed by the Agri-Food firms had not been homogeneous. In order to link the lack of convergence with the strategies developed by the agri-food firms, we resort to the SSA analysis to explain the differences between the firms and the different components that explain the performance of the Agri-Food Industry.

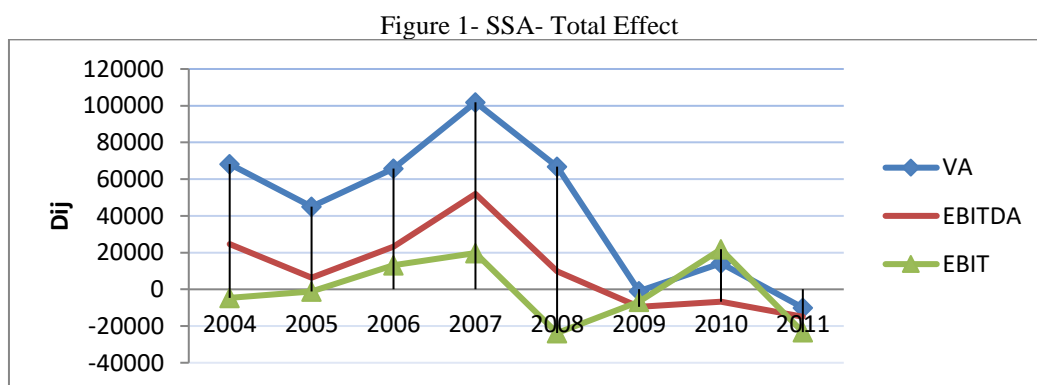
#### 4.2 SSA ANALYSIS

Our SSA analysis of the Spanish agri-food industry exhibits some properties derived from the time

period used in the analysis that provides special relevance to the results obtained. To that effect, we have elected to utilize, as done by Dinc et al (1998) and Dinc and Haynes (1999), signs to reflect the increases or decreases that may have taken place in the years of economic bonanza, with positive growth rates in the performance variables selected, *VA*, *EBITDA* and *EBIT*, prior to the crisis and in the recessionary years between 2008 and 2011. Note further that we consider 2007 to be a growth year, since the crisis started at the end of such year and hence it was not reflected in the values of the performance variables.

#### 4.2.1 Utilization of the performance variables in SSA

Each performance measure is related to a particular growth variable utilized and, as explained earlier, it reflects a given component of business policy. Hence, in this section, we present the results between the SSA components and the variables of economic performance. As shown in Figure 1, the evolution of the three variables is not symmetrical in time and therefore the differences among these variables are not constant in time either. This implies the possible existence of negotiating positions that may explain different competitive and growth effects depending upon the performance variable utilized. Observe also the existence of a “floor value” for *EBIT* that leads to the computation of financial ratios as important as *ROA* (Return on Assets) and *ROI* (Return on Investment). For these reasons, we include in this section comments on the results related to the three performance measures considered in the paper.



Source: Own elaboration

Start with the *Total Effect*. Its overall impact is negative with respect to the three performance variables analyzed. Further, such impact is relatively homogeneous, in the sense that, whenever the results for a given variable adopt a given sign, either positive or negative, all three tend to maintain it. Negative impact results are also found, the only exceptions of positive growth occur in one region, the South (ES6) and in the sectors associated with Fish (102), Fruit and Vegetables (103) and Vegetable and Animal Oils and Fats (104). In general, the evidence clearly underscores the predominance of the economic crisis influence on the global SSA results.

With respect to the components of the Total Effect, the 2004-2011 time period yield positive AFI

growth results for both the National ( $NI_{ij}$ ) and Regional ( $RI_{ij}$ ) Industry-Mix factors, bringing to light the presence of significant regional specialization factors and the need to identify which regions and sectors are primarily responsible for their existence. Of particular interest are the positive signs of the Competition Effect ( $C_{ij}$ ), since they reflect additional competitive capacity for agri-food growth, through its regional and sectorial specialization efforts.

In conclusion, the results analyzed so far suggest the presence of a specialization component of regional/sectorial nature, which leads to positive overall growth rates. This justifies further analysis on the nature of such component.

#### 4.2.2 Impact of the economic cycle on AFI growth

To study the impact of the economic cycle on agri-food industry growth, we have divided the total study period of 2004-2011 into two sub periods: (i) the 2008-2011 years, covering the more recent economic crisis; and (ii) the earlier 2004-2007 time period of relative economic boom. The Total Effect results of Table 5 summarize the main implication of this exercise, namely that the expected positive signs during the boom period turned negative during the economic crisis, in the cases of *VA* and *EBITDA*, but not for *EBIT*. Hence, agri-food firms were able to make decisions dealing with provisions and amortizations that lead to positive results for *EBIT*, even during recessionary periods.

Furthermore, for the rest of the SSA components, it is worth observing the positive effects of the three regional components, even throughout the crisis period, which leads us to conclude that the agri-food is a sector able to grow throughout the different stages of the economic cycle, mostly due to the competitive dynamism of regional, rather than the national, specialization policies.

In addition, the Homothetic/Regional decomposition results bring forward two additional factors. First, they reinforce the importance of the Residual Competition Effect in explaining agri-food growth, primarily through regional specialization. Second, the Homothetic component exhibits positive values for the majority of the SSA factors during the economic boom period, which implies that the agri-food sector general trend itself is able to lead to positive growth.

#### 4.2.3 SSA regional

To illustrate the nature of the regional effect on the AFI competitiveness, we have selected two regions, the South and Cataluña that illustrate two very distinct approaches to impact their growth. The growth patterns of the South are aligned to the national expected positive Homothetic results, whereas Cataluña's, even with negative expectations, exhibits positive growth results, due to its specialization advantages, as they appear in the Residual components. As shown in Table 5, the first evidence of such differences occurs in the comparison of the Total Effect results for both regions, where the expectations for Cataluña (the South) are shown to be negative (positive, We expand upon these results throughout the



remainder of this section.

Similar evolution of signs suggests that the average sectorial tendency measured by the National growth component is negative for both regions considered. However, when analyzing the regional components, there exists substantial changes in the competitive positions of both regions. The South experiences positive changes only in Regional Growth, but no sufficiently strong to generate favorable movements in the Competition Effect. On the other hand, Cataluña's strength is manifested in the Regional Industry-Mix component that is also carried over to the Competition Effect.

In terms of the performance variables, the South behavior is rather homogeneous. However, Cataluña exhibits sign changes, depending upon the variable considered. For example, the Competition effect is generally explained by positive values for *VA* and *EBITDA* and negative for *EBIT*. Similarly to the impact of the nation as a whole, such result is attributable to the impact of amortizations and provisions, resulting from high levels of depreciation expenditures, as a consequence of large investments in fixed assets or from outlays associated with risk coverage.

The analysis of the Homothetic and Residual effects also yield important differences between the two regions. Cataluña's Total Effect Residual components are all positive, which implies that the competitive capacity of this particular region do not follow the AFI's. Rather, it is its specific sectorial-regional specialization pattern that is responsible for its competitive advantage. On the other hand, the South exhibits different behavior, more closely related to the agri-food sector tendency, i.e. it takes advantage of the National Industry-Mixed effect, as well as of the two regional effects, but not strongly enough to achieve positive Competition Effect signs.

From the point of view of the economic cycle, there exists behavioral differences between the regions, in terms of the Total effect and of the performance variables analyzed. The majority of the expected signs are positives in both regions, during the boom period, whereas the crisis period exhibits different behavior between the regions. Cataluña's case is one of negative signs in some components like National Growth, National Industry-Mix and Regional Growth, whereas positive results appear in the Competition and Regional Mix components. This pattern reflects the ability of Cataluña to maintain a positive competitive position throughout the entire economic cycle, as a result of its ability to attract capacity and develop regional specialization patterns at any cycle phase.

On the other hand, the South exhibits positive signs in most of the components of the Total Effect, even during crisis periods, which leads to conclude that the sector/region combination tends to dynamize positively its competitive position.

#### 4.2.4 SSA sectorial

Of all the sectors analyzed, we have selected for further analysis two sectors of the Spanish agri-food sector, namely Fruits and Vegetables (103) and Alcoholic Products (110), with highly differentiated

residual behavior and with quite relevant sign changes among the three development measures. Table 5 summarizes the resulting information.

The Fruits and Vegetables (103) sector achieves its positioning through the National Industry-Mix effect, i.e. through the sector's regional specialization. From the point of view of the Competition Effect, the best results arise from *VA* and *EBITDA*, while *EBIT* yields negative signs, mostly generated through the Regional Growth values. Hence, the variation is explainable through the market's competitive value. The opposite situation takes place with respect to the Regional Industry-Mix effect, which suggests that the higher the specialization in the regional activities the more negative the values for *VA* y *EBITDA* and the more positive those for *EBIT*, hence reflecting once again the "floor" effect over the exploitation results. Furthermore, the Alcoholic Products (110) sector is the more volatile discussed in this paper. This is likely due to two characteristics unique to this sector. One deals with its pluriannual production cycles, which renders feasible the possibility of smoothing out the data throughout each cycle. The other relates to its partially regulated structure, which has recently suffered substantial legal modifications that have resulted in associated corresponding changes in the strategies of the firms in its midst. This can be observed in the European Union Council Regulation EU 2008, which affects the production, elaboration and commercialization of wine in the entire EU. Such regulation was modified in 2008 through the elimination of all the distillation aid. As a result, wine firms had to modify their market strategies, by searching for international markets for their product, within a period of economic crisis that substantially affected their performance measures. This is reflected in the alternancy of signs in the sector's Total Effect, with negative signs for *VA* and *EBIT* and positive for *EBITDA*, reflecting the fact that personnel expenditures are not the most relevant for this sector. With respect to the components of the Total Effect, the signs are positive for *VA* and *EBITDA* and negative for *EBIT*, in much the same way it occurs for Fruits and Vegetables. With respect to the Homothetic and residual components, there are positive signs in all Total Effect and National Growth residual values for the two sectors, which renders these components more dynamic than average.



The pattern of sign changes in the measurement variables reflects two types of behavior. On the one hand, we observe sets of results consisting of positive values for *VA* and *EBITDA* and negative for *EBIT*. This reflects an intensive investment effort in the part of agri-food firms that leads to a substantial increase in amortizations and provisions, which impacts negatively on *EBIT* in the short run, while it will help with the long run competitive behavior of the firm. On the other hand, there exists the pattern of negative values for *VA* and *EBITD* and positive for *EBIT*, which reflects the firms' intention not to invest or to enlarge the amortization period, in exchange for a more positive exploitation result, in light of the importance of *EBIT* in the computation of the profitability of the firm. Such double behavioral pattern occurs recurrently in the global results as well in those obtained per economic cycle, sector and region and leads us to establish differences in the competitive positions of different sectors and regions. In addition, it allows us to utilize different variables as development measures, which provides complementary information with respect to growth and competition prospects of the various firms, with the corresponding improvement in the quality of the decisions made with respect to these factors.

## 5 SOME CONCLUDING COMMENTS

The study of the competitive factors of the agri-food sector is relevant to the Spanish economy since such industry represents one of the economic strengths of the national economy. In terms of number of firms, of employment and of growth, the evolution of the agri-food sector is quite positive, especially during crisis periods. The principal results of the current work are directed to identify the determinants of such competitive strength by sector of activity, region of operations and phase of the economic cycle.

The first important result is to observe that the agri-food industry is not converging, in terms of  $\sigma$  convergence, which in turn invalidates the possibility of obtaining also  $\beta$  convergence. In fact, the evidence suggests that the temporal evolution of  $\sigma$  convergence points towards growth rather than towards diminution, with the lowest levels corresponding to the South (ES6), among the regions and to the Farinaceous Products (107), among the sectors. Hence, territorial convergence is not occurring. Rather, the phases of the economic cycle, specially the economic crisis, are accelerating the speed of such divergence.

From the point of view of the global results, there exists Expected, i.e. Homothetic, positive results for the majority of the SSA components, during the boom period. However, when analyzing the time of economic crisis, positive results occur only in the Residual components, related to National and Regional Growth for *EBIT*. In addition, the territorial results identify an agri-food sector with substantially different growth strategies across the different regions. As an example, The South exhibits positive signs in the Homothetic component, thus representing the standard behavior of the Spanish agri-food industry, for the global components and for the National and Regional Industry-Mix and Competition Effects. On the other hand, Cataluña represents a rather differentiated regional structure, with negative Homothetic signs for all components. Hence, its AFI structure is quite different to the national average. In fact, it is the region itself

that establishes its competitive position through strategies reflected in the Residual components.

In addition, our analysis of the two economic sectors has also identified substantially different behavior among them. The Fruits and Vegetables sector shows the best Homothetic results for the entire economic cycle. This implies its position as one of the defining sectors of the Spanish agri-food sector, as shown in the importance of its sales and exports to the national economy. Finally, the Alcoholic Products Sector presents a rather unequal behavior. This is caused to a great extent to the fact that this sector combines the production and sale of two rather different products, namely of wine on the one hand and of "Jerez" and "cava" on the other. The SSA results indicate positive expectations in Regional Industry-Mix and sign alternancies in all the other components.

Finally, this paper has contributed to explain the differences in growth of the agri-food sector and explain the weight of the territorial factors in the competitiveness. The consideration of the sector as a single sector homogeneous is not appropriate to explain their strengths and the better behavior during the crisis period.

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