REGIONAL DEVELOPMENT AND AGRI-FOOD INDUSTRY IN SPAIN

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Abstract

The objective of this paper is to analyse the evolution of the agri-food industry and its relationship with regional development in Spain over the last years. The Spanish agri-food industry recent evolution and its actual situation have been analysed. Its relative importance, both at national and regional level, is also described.
A classification of Spanish regions based on their agri-food development has been done. Different multivariate techniques (factor and cluster analysis) have been used to classify regions. Results have allowed to determine the relationship between the agricultural sector and the agri-food industry.
The agri-food industry relative growths, regionally and nationally, have been compared over the last years using the shift-share analysis. Finally, factors affecting location of the agri-food industry have been specified by using regression techniques. The situation in 1988 has been compared with that in 1981.

Résumé

L'objectif de cet article est d'analyser l'évolution des industries agro-alimentaires ainsi que leur rapport avec le développement régional en Espagne pendant les dernières années. Nous analysons l'importance relative du secteur agro-alimentaire dans l'ensemble de l'économie, au niveau national et régional.
On a fait une typologie des régions selon leur développement agro-industriel. Pour cela, différentes téchniques d'analyse des données ont été utilisées telles que, l'analyse factorielle et l'analyse hiérarchique. Les résultats obtenus montrent le rapport dans les régions entre l'agriculture et l'industrie agro-alimentaire.
D'autre part, on a comparé, à l'échelle régionale et nationale, la croissance entre 1981 et 1988 des industries agro-alimentaires à partir de l'analyse shift-share. Finalement, on a étudié les facteurs de localisation agro-industrielle en utilisant la régression linéaire.

The agri-food industry is one of the most important industrial sectors in Spain. Moreover, the impact of the two oil crisis during the seventies has been less important than in any other sector of the Spanish economy. The Spanish economic development, among other factors, has increased the demand for more elaborated agri-food products during the last years.
The political transition towards a democracy, which took place by the middle of the seventies, generated a process of government decentralisation. The outcome has been 17 autonomous regions.
Traditionally the agri-food industry has been close to agriculture. The migration process to urban areas, changing consumption patterns (new consumers look for more quality and elaborated products), less expensive transport costs of raw agricultural commodities in comparison to elaborated products and the existence of more powerful distribution chains, have shifted, to a certain extent, the location of agri-food industries from rural to urban areas. As a consequence the Spanish less developed regions are loosing a significant part of the agricultural products value added.
The objective of this paper is to analyse the evolution of the agri-food industry and its relationship with regional development in Spain over the last years.
The paper is organized as follows. The Spanish agri-food industry recent evolution and its actual socioeconomic relevance is analysed in section 1. In section 2, a classification of Spanish regions based on their agri-food development has been undertaken. Also, regional relationships between the agricultural sector and the agri-food industry have been established. Factors affecting the location of the agri-food industry have been specified in section 3 by using regression techniques. Finally, some conclusions are outlined.

The agri-food industry in Spain: recent evolution and socioeconomic importance

The food processing industries (FPI) is the most important industrial sector in Spain. Total gross production was around 5 billion pta ([1]) in 1988 which aproximately represents 20% of total industrial production. The gross value added (GVA) generated by FPI was 1,3 billion pta (14.7% of the GVA obtained by all industrial sectors) and it was the second more important industrial sector after Energy (INE, 1991).
Figure 1 shows the evolution of the production index (in constant values) both in the food industry and in the entire industrial sector. The second oil crisis had a negative impact on the industrial sector over the first half of the eighties although there was a recuperation starting in 1986. The impact on the food industry was even worse than on the whole industrial sector. The food industry production index has been significantly below the industrial sector one over the 1978-1985 period.
The same negative effect can be found when we analyse the evolution of the gross value added index (**figure 2**). However, in this case, the impact on the food industry has been less negative than on the entire industrial sector. Comparing production and gross value added indexes, it can be concluded that the food industry has been more efficient reducing production costs.
The FPI employed 359,418 workers in 1988 (16.7% of total employement in the industrial sector). The number of factories related to the agri-food industry was quite high. Almost 25% of the total number of industrial factories were included in this sector (41,487). Consequently the average FPI factory size has been below the industrial sector average size. The evolution, in relative terms, of these two magnitudes (employment and number of factories) over the last years has been steady (**figure 3**).
The number of agri-food processing factories has diminished between 1978 and 1988, with a loss of 11,930 factories which represents a 21% reduction with respect to the 1978 situation. The employment has also reduced in 12% (408,922 and 359,418 workers in 1978 and 1988, respectively).
The important decrease of the number of factories in the agro-food industry has not meant a high increase of factory size. The average factory dimension has slightly increased from 7.7 to 8.6 workers between 1978 and 1988. Although a concentration process has been taken place, 93% of the factories still had less than 20 workers in 1988. An explanation to this phenomenon is that in the agri-food sector market opportunities change continuously so, there is a constant process of small firms creation and disappearence.
Labour productivity in the food industry has been increasing in the last years and always above the industrial sector (**figure 4**).
The importance of the FPI is not homogeneous at regional level. **Table 1** shows the

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([1]) 1 US $\$ \approx 100$ pta and 1 billion $= 10^{12}$.

main structural magnitudes associated with the agri-food industry in each region.
Firstly, only two regions produced 40% of total FPI production (Cataluña and Andalucia produced 21.1% and the 18.3%, respectively). The second group was formed by three regions that altogether represented around 25% of total production (Castilla-Leon, 9%; Comunidad Valenciana, 8.1% and Madrid, 7.3%).
Employment distribution over the different regions showed a similar pattern than production. Again, Cataluña and Andalucía were the most important regions accounting for 16.7% and 18.3%, respectively. Another 35% were distributed among Comunidad Valenciana (9.5%), Castilla-León (8.4%), Madrid (7.6%) and Galicia (6.8%).
A productivity regional indicator has been obtained combining production and employment data. Results are in **table 1**.
National average was 14.3 million pta/worker. Productivity in Murcia and Extremadura were well under average (9.2 and 10.0 millons pta, respectively). The highest productivy was found in La Rioja and Cataluña (18.6 and 18.0 million pta/worker, respectively). Also, Asturias, Castilla-León and País Vasco were above average. Andalucía, Aragón, Cantabria, Castilla-La Mancha, Galicia and Madrid were around the average. Finally, Baleares, Canarias, Valencia and La Rioja were below the national average.
Last column in **table 1** shows the reginal importance of the FPI in comparison with the entire industrial sector in each region. As we have already mentioned, the FPI generated 20% of the total industrial production, at national level.
Big differences were found when regional figures were analysed. The FPI was the most important industrial sector in La Rioja. It accounted for 43% of the regional industrial production although its contribution to the national agri-food industry was quite low (2.1% of total production and 1.6% of total employment). La Rioja is, then, a particular case, existing a strong relationship between the agricultural production and the agri-food industry.
The FPI also played an important role in Canarias, Andalucía, Baleares and Murcia regional industry (39.4%, 37.6%, 32.0% and 31.4%, respectively). In the opposite side, we found País Vasco (8.2%), Madrid (13.2%), Aragón (14.7%) or Asturias (14.8%).
However these latter figures do not mean that in these regions the food-industry was not important.
For example, in Aragon, the FPI was the second industrial sector both in production level and in employment.

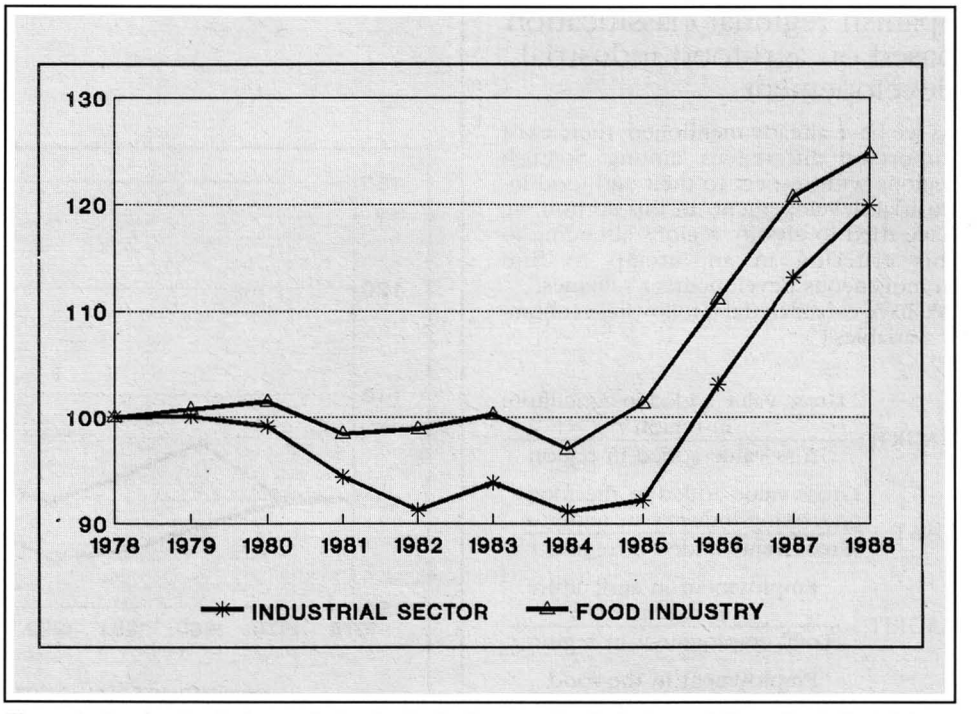

Figure 1 - Production index evolution in the food processing industry and the entire industrial sector (1978 = 100).
Source: INE, several years. Anuario de Estadística.

Table 1 ***Food processing industry production, employment and labour productivity in Spanish regions (1988).***

	FPI Production (1)	FPI Employment (2)	Labour productivity (3)	FPI production / IND production (4)
Andalucia	934,0	65,5	14,3	37,6
Aragon	167,2	11,4	14,7	14,7
Asturias	122,0	7,9	15,4	14,8
Baleares	62,4	5,5	11,3	32,0
Canarias	133,1	11,4	11,7	39,0
Cantabria	94,8	7,1	13,4	24,6
Cast-Leon	456,4	30,0	15,2	24,3
Cast-Mancha	257,5	17,9	14,4	27,1
Cataluña	1074,1	59,7	18,0	16,8
Valencia	410,3	33,9	12,1	16,1
Extremadura	84,7	8,5	10,0	28,1
Galicia	323,7	24,3	13,3	23,5
Madrid	372,6	27,3	13,6	13,2
Murcia	154,7	16,8	9,2	31,4
Navara	133,2	11,8	11,3	19,5
Pais Vasco	201,3	13,1	15,4	8,2
Rioja	108,0	5,8	18,6	43,0
España	5090,0	357,9	14,3	19,9

(1) in 10^9 pta
(2) in thousands of workers
(3) in 10^6 pta
(4) in percentage
Source: INE 1991. Encuesta Industrial, 1985-88. Ministerio de Economía, Madrid.

Spanish regional classification based on agri-food industrial developement

As we have already mentioned, there exist important differences among Spanish regions with respect to their agri-food industrial developement. In this section we have tried to classify regions attending to this criterion in an attemp to find homogeneous developement schemes.
We have considered the following economic variables (2):

$$VAGRT_r = \frac{\text{Gross value added in agriculture in region } r}{\text{Gross value added in region } r}$$

$$VAAT_r = \frac{\text{Gross value added in the food processing industry in region } r}{\text{Gross value added in region } r}$$

$$EAGRIT_r = \frac{\text{Employment in agriculture in region } r}{\text{Total employment in region } r}$$

$$EIAAT_r = \frac{\text{Employment in the food processing industry in region } r}{\text{Total employment in region } r}$$

R_r = Per capita income in region r

Factor analysis and cluster analysis have been used to classify regions by using these variables. The objective of using factor analysis was to condense information from the five original variables in a lower number of factors (artificial variables).
Relationships between regions and original variables have been established using these factors. A deep exposition of such multivariate technique can be found in Harman (1966), among others.
The cluster analysis allow us to classify regions in homogeneous groups, unknown a priori, in such a way that distances among regions within the group are lower than distances among regions from different groups. Further information can be found in Benzecri (1982). In our case, the regions classification has been made based on the in-

Table 2 ***Correlation matrix between original variables and the two first factors.***

	F1	F2
VAGRT	0.96	−0.05
VIAAT	0.42	0.84
EAGRIT	0.81	−0.39
EIATT	0.60	0.70
RENTA	−0.59	0.68
% Total Variance	49.8	36.6

Source: Results of the analysis.

(2) All data are referred to 1986. Data source is: Instituto Nacional de Estadìstica, 1991. Contabilidad Regional de España.

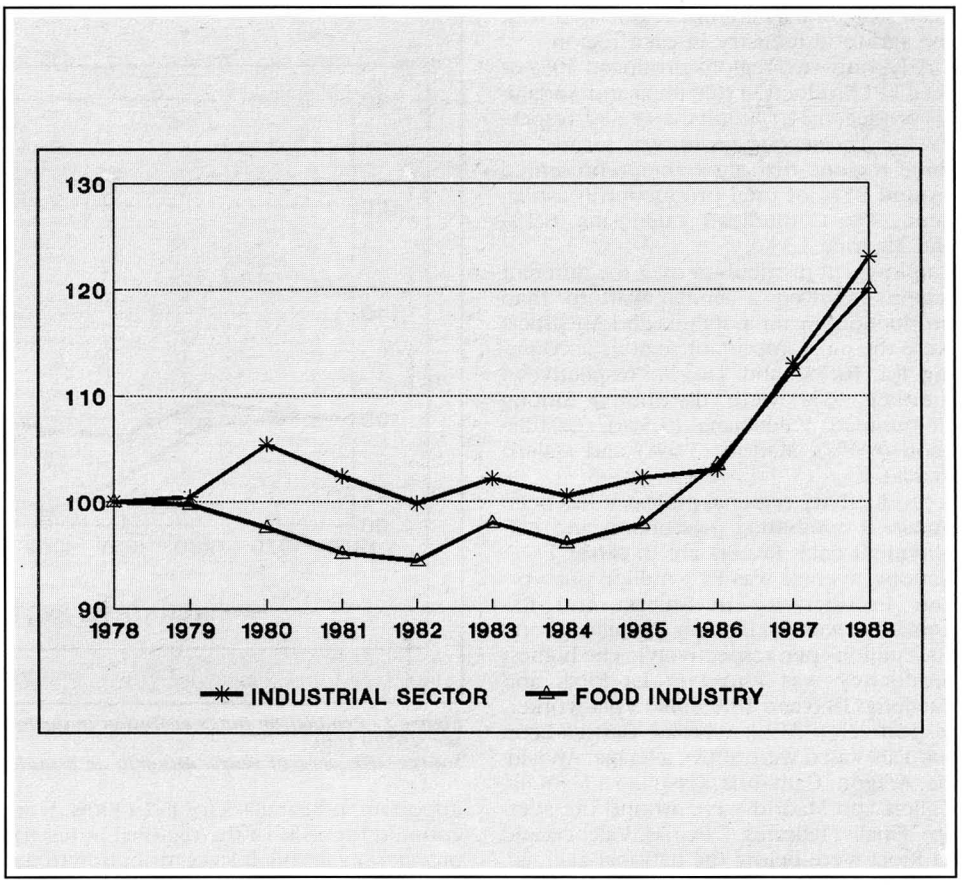

Figure 2 - Gross value added index evolution in the food processing industry and the entire industrial sector (1978 = 100).
Source: INE, several years. Anuario de Estadística.

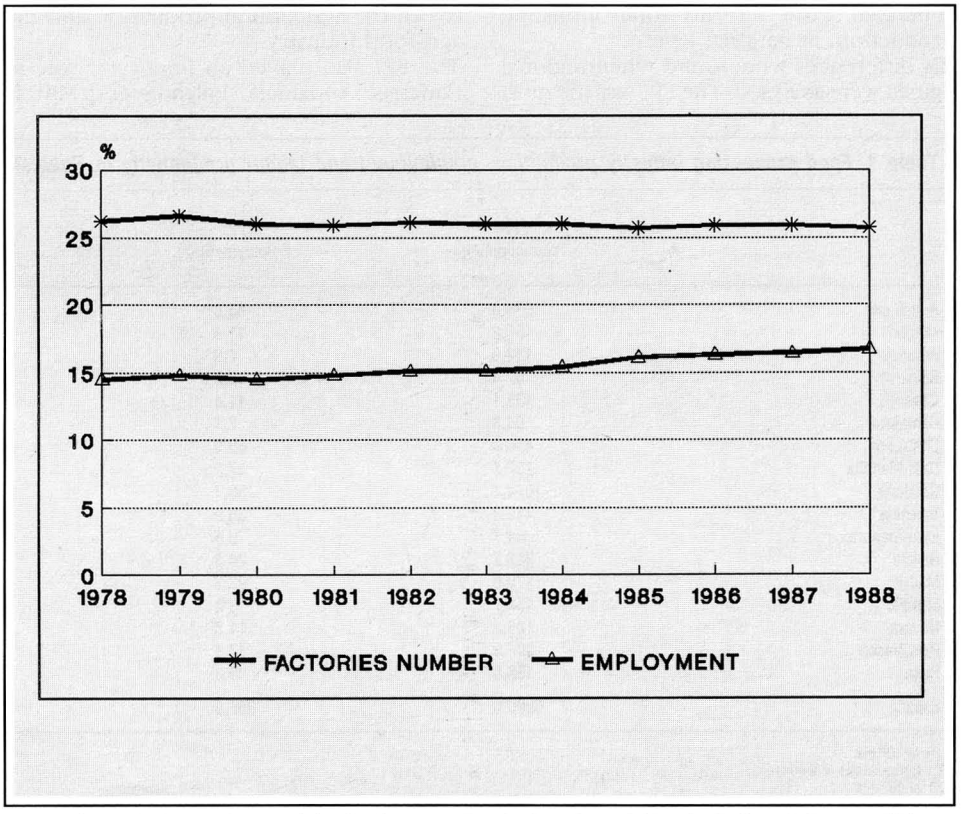

Figure 3 - Relative position of the food processing industries within the industrial sector (%).
Source: INE, several years. Anuario de Estadística.

formation from the two first factors derived from the factor analysis.

Table 2 shows the correlation matrix between original variables and the two first factors. Both explained 86.5% of the total variance.

The first factor (F1), which explained 49.8% of the total variance, was significatively and positively correlated with variables related to the agricultural sector ($VAGRT_r$ and $EAGRIT_r$) and negatively correlated with the per capita income (R_r). So, this factor divided regions in two main groups: in the first, regions with low per capita income level and where agriculture played an important role; in the second, regions with higher income level and agriculture playing a residual role.

The second factor (F2), explained 36.6% of the total variance. It was significatively and positively correlated with per capita income (R_r) and the agri-food industry variables ($VIAAT_r$ and $EIAAT_r$). So, this factor gathered regions where the agrifood industry played an important role in the regional economy and per capita income above the national average.

Figure 5 shows the relative position of each region considering the two first factors. Results from the cluster analysis have been also included. The seventeen regions have been classify in seven homogeneous groups.

Table 3 includes the average values of the original variables for each group.

Madrid, País Vasco, Baleares and Cataluña formed the first group. The main characteristics of this group were a high per capita income level and an agricultural sector and agrifood industry of relative little importance in the regional economy. These were the most developed regions in Spain.

Galicia and Extremadura formed Group II. Per capita income was below the national average and agriculture played an important role in their regional economy. The agri-food sector has not been well developed so, there exist a loss of value added, in these regions.

Something similar happened to regions forming group III (Andalucía, Castilla-León and Castilla-La Mancha). They had higher per capita income than those of group II and the relative importance of the agricultural sector was lower. The main difference was that the agri-food industry was more developed than in the latter case. However, it was still below the national average although there were opportunities for further development.

Aragón, Asturias, Canarias, Cantabria and Valencia formed group IV. We can call them the average regions. Original variables average values in these regions were quite similar to national average.

The rest of the groups were only formed by one region. Murcia (Group V) had a lower income level than the national average. The agricultural sector had a higher relative importance but the agri-food industry was very important in terms of employment. FPI gross value added figures were around national average levels.

Navarra (Group VI) had an income level above the national average. Agricultural developement was not very high. However, the agri-food industry played an important role both on employment and gross value added levels.

The last group included Rioja (Group VII). An important agri-food industry has been developed based on its agricultural sector. Most of the value added generated by the FPI reverted in the regional economy. Using agricultural raw materials produced in the region a well-known agri-food industry

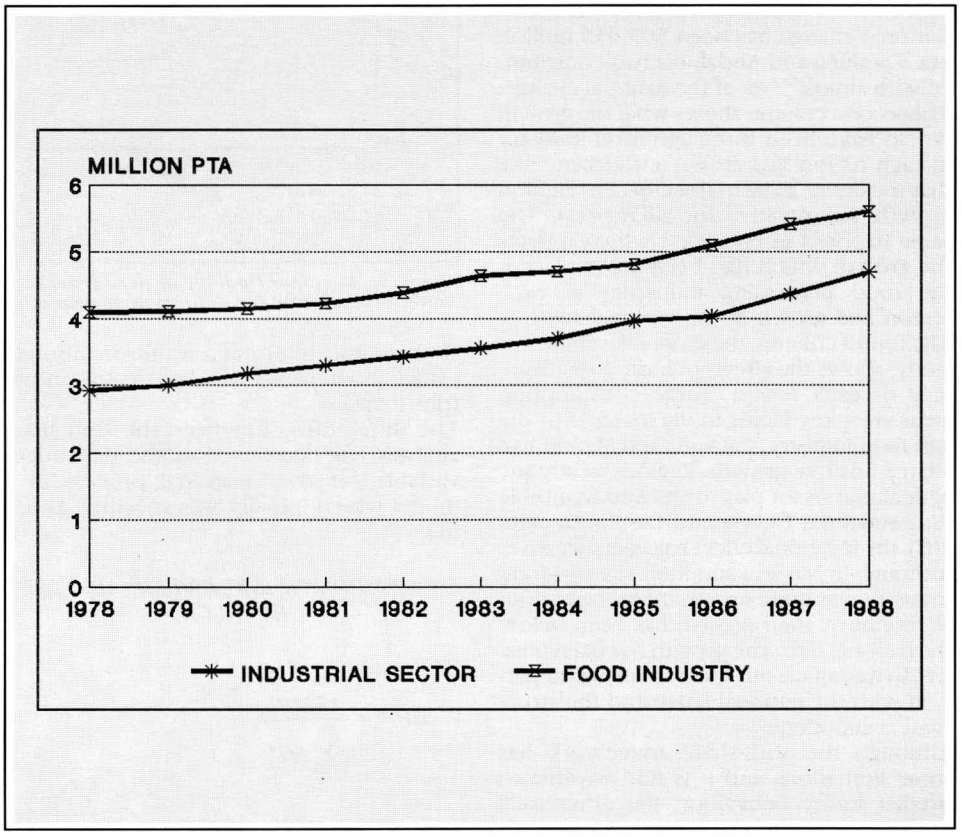

Figure 4 - Labour productivity in the food processing industry and the entire industrial sector in Spain (million pta, constant values).
Source: INE, several years. Anuario de Estadística.

has been developed. Rioja had also, with Baleares, the highest per capita income in Spain.

Factors affecting the location of agri-food industries in Spain

As a first step, the shift-share framework has been applied on production data in the food processing industries. The objective of this analysis was to determine the regional advantages to develop the agri-food industry. Production variation between 1981 and 1988 has been decomposed in the following way:

$$GP^{t}_{AR} - GP^{0}_{AR}T_N + GP^{0}_{AR}(T_{AN} - T_N) + + GPA_0(T_{AR} - T_N) \quad (1)$$

where GP^{i}_{AR}, $(i = 0,t)$ is the regional agri-food industry production in year i (constant values), T_N is the real growth of the entire industrial sector at national level, T_{AN} is the real growth of the agri-food industry at national level and T_{RN} is the real growth of the agri-food industry at regional level.
The three components in (1) are: the national share, the estructural component (or proportional shift) and the competitive component (or differential shit), respectively. Results from this analysis are in **table 4**.
Total production change in the agri-food industry in each region is shown in the first column. All the regions, except Rioja, have increased the production level in real terms. National change has been 592,030 million pta. Cataluña and Andalucía had contributed with almost 50% of the national change.
The second column shows what the growth would have been if the agri-food industry in each region had grown at the same rate that the entire industrial sector. Production growth was positive for all regions. The same happens in column 3 which reflects the growth which had been taken place if the food processing industries in each region had grown at the national rate.
The fourth column, the more relevant in our study, shows the effects of locational advantage of each region. Large consumption areas are a key factor in the location of the agri-food industry. Cataluña and Madrid had a large positive growth. Regions where the agricultural sector played and important role (Extremadura, Galicia and Castilla-La Mancha), the locational effect has been negative. Although in Navarra and Rioja the agri-food industry was quite important in the regional economy, their growth has been below the national rate. The growth has been positive in Andalucía but quite small in comparison with the national share and the structural component.
Although the shift-share framework has some limitations and it is not possible to predict future behaviour, the differential

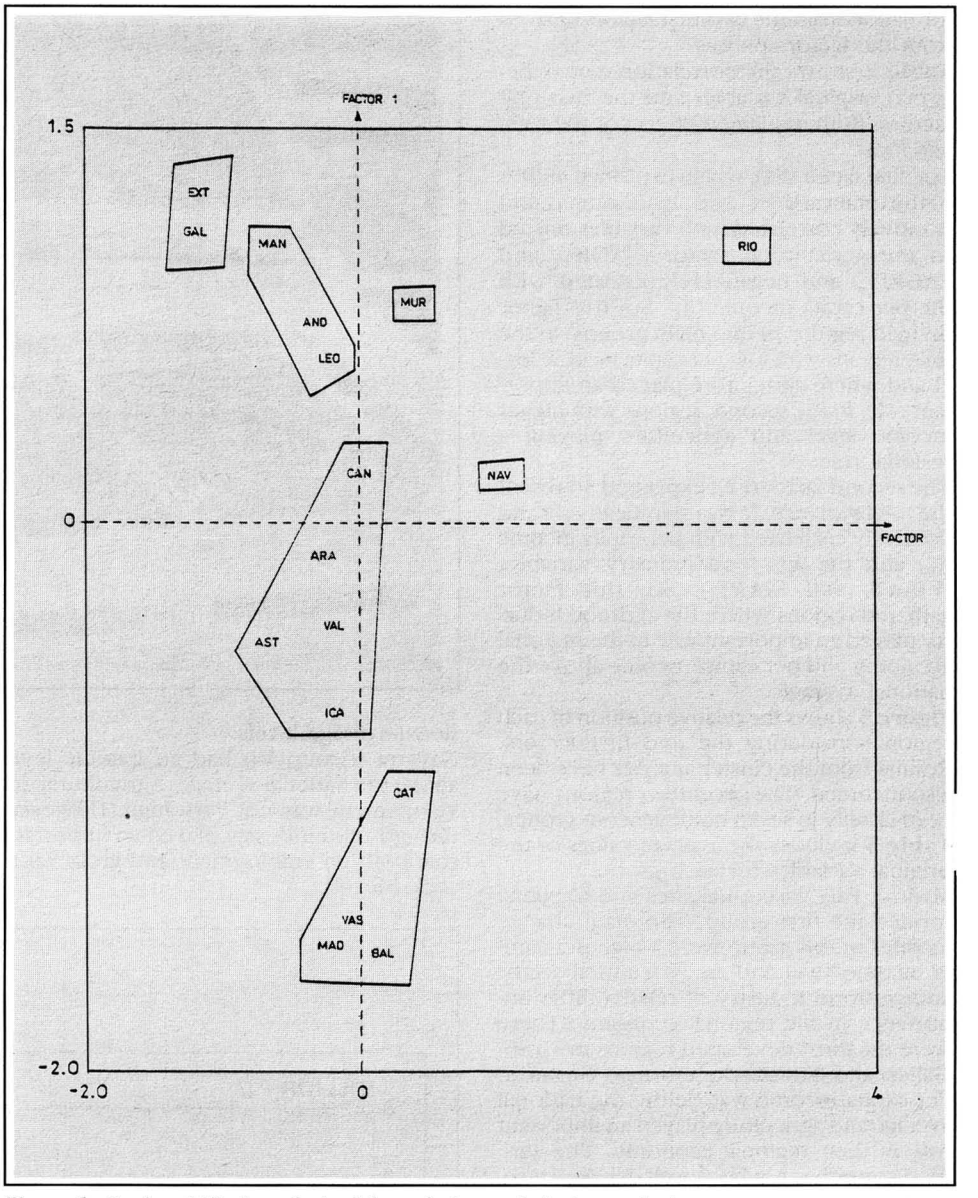

Figure 5 - Regional tipology derived from factor and cluster analysis.
Note: See Appendix for definition of abbreviations.

shift analysis reinforced results mentioned earlier about the agri-food processing industries location.
The differential shift from the shift-share analysis has been used as the dependent variable for the locational process in a model which initially was specified as follows (3):

$$DS^{t}_{r} = f(MPR^{0}_{r}, WR^{0}_{r}, \Delta W_{r}, FWRLR^{0}_{r}, APR^{0}_{r}, \Delta AP_{r}, RP, I^{0}_{r}, LCR^{0}_{r})$$

where:

i) $$MPR^{0}_{r} = \frac{15MP^{0}_{r}}{\sum_{i=1}^{15} MP^{0}_{i}};$$

$$MP^{0}_{r} = \sum_{r \neq j} \frac{GRP^{0}_{j}}{d^{b}_{rj}} + \frac{GRP^{0}_{r}}{\sum_{k=1}^{m} \frac{d^{b}_{rk}}{m}}$$

where:

i = 1, 2, ..., r, ..., 15.

MPR^{0}_{i} = market potential ratio in region i.

MP^{0}_{i} = market potential in region i, year 0.

GRP^{0}_{j} = gross regional product in region j (j = 1, ..., 15).

d^{b}_{ij} = distance from the capital town in region i to the capital town in region j.

d^{b}_{ik} = distance from the capital town in region i to the rest of province capitals in the same region.

b = 1.5.

m = number of province capitals in.

ii) $$WR^{0}_{r} = \frac{15W^{0}_{r}}{\sum_{i=1}^{15} W^{0}_{i}}$$

(3) The superindex t refers to year 1988 and the 0 one to year 1981.

Table 3 ***Average values of the original variables of the groups formed by the cluster analysis.***

Region	VAGRT	VIAAT	EAGRIT	EIAAT	RENTA
I					
Madrid					
País Vasco					
Baleares	1.8	2.8	4.4	2.6	976.0
Cataluña					
II					
Andalucía					
Castilla-León	12.0	4.5	22.7	4.3	672.6
Castilla-Mancha					
III					
Extremadura					
Galicia	13.6	3.3	33.8	3.2	593.1
IV					
Aragón					
Asturias					
Canarias	6.2	3.8	14.0	3.4	784.8
Cantabria					
Valencia					
V					
Murcia	11.5	4.8	17.4	6.8	741.2
VI					
Navarra	7.6	6.0	11.0	6.6	909.5
VII					
La Rioja	12.4	16.8	15.1	7.1	1,089.2
España	7.8	4.6	15.7	4.0	810.1

Source: Results of the analysis.

Table 4 ***Shift-share analysis for the agri-food industry between 1981 and 1988 (million pta (*)).***

Regions	Total Change (1981-1988)	National Share	Proportional Shift	Differential Shift
Andalucia	113.139	90.043	16.800	6.296
Aragon	15.772	17.023	3.176	−4.428
Asturias	11.804	12.360	2.306	−2.862
Baleares	7.724	5.984	1.116	624
Canarias	24.676	11.124	2.075	11.476
Cantabria	15.213	8.395	1.566	5.252
Cast.-Leon	56.985	43.667	8.147	5.171
Cast.-Mancha	17.968	24.471	5.125	−14.628
Cataluna	168.417	95.870	17.887	54.660
Valencia	45.464	40.408	7.539	−2.483
Extremadura	1.649	9.893	1.846	−10.090
Galicia	23.813	34.290	6.398	−16.875
Madrid	53.198	34.314	6.402	12.483
Murcia	24.343	13.794	2.574	7.975
Navarra	10.401	13.996	2.611	−6.207
Pais Vasco	4.130	23.462	4.377	−23.709
Rioja	−2.668	13.568	2.531	−18.767

(*) 1 US$ ≃ 100 pta.
Source: Instituto Nacional de Estadística. Several years.
Encuesta Industrial.

where:

i = 1, 2, ..., r, ..., 15.
WR_i^0 = wage ratio in agri-food industries in region i.
W_i^0 = wage in agri-food industries in region i.

iii) $\Delta W_r = W_r^t - W_r^0$ (*constant values*)

iv) $$FWRLR_r^0 = \frac{15 FWRL_r}{\sum_{i=1}^{15} FWRL_i}$$

where:

i = 1, 2, ..., r, ..., 15.
$FWRLR_i^0$ = food wholesaler and retailer licenses ratio in region i.
$FWRL_i^0$ = food wholesaler and retailer licenses in region i.

v) $$APR_r^0 = \frac{15 AP_r^0}{\sum_{i=1}^{15} AP_i^0}$$

where:

i = 1, 2, ..., r, ..., 15.
APR_i^0 = agricultural production ratio in region i.
AP_i^0 = agricultural production in region i.

vi) $\Delta AP_r = AP_r^t - AP_r^0$ (*constant values*)

vii) RP_r = regional policy. It is a dummy variable which takes the value of 1 in region that have received more money from the EC structural fund.

viii) $$IR_r^0 = \frac{15 I_r^0}{\sum_{i=1}^{15} I_i}$$

where:

i = 1, 2, ..., r, ..., 15.
IR_i^0 = per capita income ratio in region i.
I_i^0 = per capita income in region i.

ix) $$LCR_r^0 = \frac{15 LC_r^0}{\sum_{i=1}^{15} LC_i}$$

where:

i = 1, 2, ..., r, ..., 15.
LCR_i^0 = labour cost per employee ratio in the agri-food industries in region i.
LC_i^0 = labour cost per employee in the agri-food industries in region i.

Most of the independent variables have been introduced in relative terms (compared with national average) and, in some cases, as variation during the 1981-1988 period. The same approach was followed by Terrasi (1984) in the Italian case.
We have excluded from our study two regions: Baleares and Canarias. Their inclusion fairly distortioned results because their specific economic and location conditions.
Independent variables can be classify in three groups. The first group deals with the agricultural sector in each region: agricultural production and agricultural production variation. We expected negative signs associated with these variables because of results in previous sections. The second group is related to the agri-food industry itself: wage and wage variation. We expect a positive sign in the wage variation variable as labour has increased in regions where the food processing industries have shown a positive growth.
The third group is related with the actual and potential regional economic development: per capita income, market potential, food wholesaler and retailer licenses and a dummy variable that we have called «regional policy» (defined above). Market potential has been defined as in Terrasi (1984) although distances within the region have been also introduced. Positive relationship between the dependent variable and market potential and food distribution licenses are expected. A negative sign is expected in the regional policy variable. We did not know at this time what the sign of the per capita income variable would be.
The final estimated model was:

$$DS_r = \underset{(3.34)}{61.27} + \underset{(1.13)}{8.81}\, MPR_r + \underset{(5.67)}{8.80}\, \Delta W_r + \underset{(5.42)}{27.75}\, FWRLR_r - \underset{(-4.09)}{25.95}\, APR_r - \underset{(-3.31)}{15.18}\, RP_r - \underset{(-3.38)}{64.42}\, IR_r$$

$R^2 = 0.95$ $R^{-2} = 0.92$ $F_{6,8} = 27.75$
Significance level = 0.001

Model fitness was quite good, although it has to be taken into account that the sample period is not large. The figures in parentheses are the t-values for the coefficients. All the coefficient were significant (at the 5% level of significance) with the exception of the MPR_r. However, its exclusion produced worse results. The Breush-Pagan Test has been carried out to test for heterokedasticity. We have accepted the null hyphotesis of homokedasticity at the 5% level of significance ($X^2(1) = 0.81$).
Signs of the coefficients were also as expected. The relative growth of the food processing industry in each region positively associated with market potential, the relative developement of the food distribution sector and wage variation.
On the other hand, it negatively related to agricultural production, regional policy an per capita income. This relationship is not surprising because the relative importance of the agri-food industry in Rioja, País Vasco, Navarra, Valencia, and Aragón (regions with per capita income above the national average) has been decreasing over the 1981-1988 period. This effect overlaps the increasing importance in Cataluña and Madrid.
Results show, as we have seen in other sections of this paper, that the agri-food processing industries tend to locate in large consumption areas whereas agricultural regions are loosing opportunities to take advantage of producing raw materials.

Conclusions

The agri-food industry has been and still is one of the most important industrial sectors in Spain. We have tried to analyse its structure, socioeconomic importance, both at the national and regional levels, and factors which have contributed to its regional location.
It can be said from the results obtained in this work that the food processing industries have tended to be located close to big urban areas. The improvements in the communications infraestructure, the migration process to urban areas, the higher income level in these areas as well as the location of large distribution chains close to the main towns reinforced this phenomenon.
On the opposite side, the most agricultural regions (generally the less developed) have lost a good opportunity for economic development. These regions export raw material to the agri-food industries of other regions and the value added generated from the transformation process is no reinvested in these regions.
Nowadays, the industrial concentration in big urban areas, the enviromental problems, the interregional as well as intra-regional development disequilibria and the economic difficulties of the agricultural sector have opened new perspectives for rural development which are not still measurable. The agri-food industry can play an important role in less developed regions where raw materials are easy to obtain. ●

Appendix

Region abbreviations

AND = Andalucía
ARA = Aragón
AST = Asturias
BAL = Baleares
ICA = Canarias
CAN = Cantabria
MAN = Castilla-La Mancha
LEO = Castilla-León
CAT = Cataluña
EXT = Extramadura
GAL = Galicia
MAD = Madrid
MUR = Murcia
NAV = Navarra
VAS = País Vasco
RIO = Rioja
VAL = Valencia

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