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Efficiency of the Italian Agri-food Industry: an analysis of "Districts Effect"

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Abstract

In the course of the past decades major transformations in the Italian food industry induced considerable structural changes: on one hand, the creation of large industrial groups, with substantial input of foreign capital and, on the other, the concentration and geographic specialisation of numerous small and medium enterprises, with the formation of specific and typical agri-food local system(districts).To take account of the presence of food districts the analysis of the Italian food industry could not be conducted at national and regional level but it has to be studied at province and local level. It is also useful to analyse the food industry with reference to the different sub-sectors.

We will conduct an in-depth analysis of the local systems(districts) of two sectors meat and fruit & vegetables processing. We will use balance-sheet data of the processing firms that were active in the meat (446 firms) and fruit & vegetables (227 firms) sub-sector in the years from 1996 to 1999. The analysis will consider the most significant balance sheet ratios, such as returns, productivity and labour cost in these local systems. Then, we will consider the economic assessment of the firms belonging to local systems of the two sectors and compare with the non district firms .For the efficiency analysis will estimate a stochastic frontier production function in order to determine the "district effect". This analysis will also be directly correlated with investment in technological innovation. The economic and efficiency analysis confirms for many aspects the presence of a "district effect" in the Italian food industry.

Keywords:

Food industry's efficiency, Food districts, Local development, Stochastic frontier production function,

Meat and fruit sectors

Efficiency of the Italian Agri-food Industry: an analysis of "districts" effect.

1 Introduction

The Italian agri-food system is still characterised by lesser importance of the agri-food industry and by being less open, in term of export and import, towards other European countries.The food industry increased its weight within the agri-food system and its added value (over 34 billion in 1997) is getting closer and closer to agriculture's added value. It represents a significant sector of the Italian manufacturing industry, after the mechanical industry (around 30%) and the textile and clothing industry (around 9%). Its evolution was in line with the general development of the manufacturing industry, even though it often experienced an anti-cyclical trend vs. other sectors. The food industry also registered sizeable increases in productivity, with an added value per worker exceeding the average of the manufacturing industry (94 million in 1996).

Major transformations of the Italian food industry induced considerable structural changes: on one hand, the creation of large industrial groups, with substantial input of foreign capital and, on the other, the concentration and geographic specialisation of numerous small and medium enterprises, with the formation of specific and typical "agri-food districts".

In this paper, we will conduct an in-depth analysis of the Italian food industry looking at different aspects. The economic and financial analysis based on the balance sheets will done on two main sub-sectors: meat (446 firms) and fruit & vegetables (227 firms). We will analyse the "district effect" for the food firms localised in the principal local systems with the estimation of the stochastic frontier production function for the firms operating in the districts of the meat and fruit & vegetables sub-sectors.

2 The Italian Food Industry

2.1 Specialisation and agrifood-districts

To understand the localisation and specialisation of production activities in the food industry is not enough do the analysis at national or regional level. The provincial level is very important, because it affords a much more accurate evaluation of geographical agglomeration of food industry in Italy (Brasili, Fanfani 2000; Fanfani, Henke 2001).

The close examination of food industry at province and municipality level results even more relevant because the concentration of the enterprises and the specialisation in the different sectors becomes even more evident. This analysis reconnects itself to the discussion on the local systems and more in particular the one on the industrial districts.

Different researchers have already tried to extend the interpretative instruments given by the industrial districts for the individuation of the agricultural and food districts. Among the elements necessary for the recognition of the presence of an agri-industrial districts, Fanfani and Montresor (1994), utilise as a starting point for the empirical analysis the following points: a) production of typical goods, b) existence of relations between agriculture and industry processing, c) flexible specialisation, intended both as flexibility in the way of producing and therefore capacity to readapt the production after quick changes of various nature of the markets, d) innovation capacity, f) development of human capital, g) support of the institutions, h) existence of a community market. A review of recent development of the analysis on agri-food districts could be found in Fanfani, Brasili (2002)

3 *The economic analysis of the agri-food enterprises*

The economic and structural changes of food industry in Italy could be examined by the study of 3,815 agri-food firms budgets (Companies with minimum turnover of two billion *lire*)

present on the Italian territory between 1996 and 1998. The analysis could be disaggregated for the main sub-sectors and for the provinces.[1]

The balance sheet analysis of the panel of food firms allowed the calculation of the most significant indicators of the economic and patrimonial situation. The indicators that we considered are: the ROI calculated as the ratio between the operative income and the invested capital (multiplied by 100); the Productivity of work calculated as a ratio between the added value and the employees; the debt ratio calculated as the ratio between the total of the passiveness and the net capital. These indicators were calculated for all the sub-sectors and on the whole agri-food industry (table 2.2).

With regards to the reading of the ROI, and therefore the operative efficiency of the firms independently from the composition of the financial sources, there is a decisive variability of value among the different sub-sectors. The rather low value of the dairy sub-sector, 3.4%, and that of fish (2.7%) shows itself immediately. A more balanced situation is found in the fruit and vegetable sub-sector which presents similar values of the ROI and of the average value of the debt ratio (around 10%), even though at the level of the median the debt ratio supersedes by two points the ROI (5.7% and 3.3%). A similar situation, but more solid is seen in the oil and vegetable fats sub-sector that have an inferior indebtedness value, equal almost 6% and a ROI also it contained but slightly higher equal to 6.5%. Also for this sub-sector the median value for the debt ratio (4.9%) supersedes that of the ROI (3.3%).

The values of the productivity of the work also show in this case a strong variability. The lower values are found in the processing of fish and the dairy sub-sector, while the most elevated value is again seen in the oil and vegetable fats sub-sector. Also for the productivity the median values point out an elevated variability between the sub-sector even though showing lower values with respect to average values. The distribution of the values is always asymmetrical to the right showing therefore a certain number of firms with vary elevated values of productivity presumably for the firms of bigger dimensions.

This concise analysis by sub-sectors confirms the composite reality of the food sub-sectors also from a point of view of the economic and patrimonial management of the firms.

Tab.2.2 Economic and financial indicators by sub-sector of the Italian Food Industry (1996-1998)

	Firms*	Employ.	Average size	Total Firms	ROI		Debt ratio		Productivity	
					Average	median	average	median	average	median
15.1 ***Meat***	780	39221	50.3	792	5.3	4.7	14.3	5.7	108.5	87.7
15.2 ***Fish***	115	4241	36.	119	2.7	3.6	-	4.2	85.3	72.2
15.3 ***Fruit & vegetables***	384	20201	52.6	399	9.9	3.3	10.5	5.7	126.5	74.3
15.4 ***Veget. oil and fat***	185	5191	28.1	190	6.5	3.3	6.1	4.9	209.8	94.3
15.5 ***Dairy***	893	26768	30.0	923	3.4	1.0	44.2	10.9	112.5	77.0
15.6 ***Grains and starches***	285	7398	26.0	288	7.0	4.8	11.3	4.2	169.8	107.3
15.7 ***Animal feeds***	225	8119	36.1	225	4.1	4.7	14.2	4.7	148.3	103.9
15.8 ***Other foods***	868	71475	82.3	878	8.8	5.2	11.5	4.4	138.1	88.9
Total	**3.735**	**182.614**	48.9	**3.814**	**6.4**	**3.6**	**16.9**	**5.6**	**133.4**	**86.0**

Source: our processing, Cerved data **Number of enterprises which have indicated also the number of employees*

4 Stochastic Frontier Production Function of the Meat and of the Fruit & Vegetables Industry

4.1 The utilised data (panel of firms)

[1] In terms of employees the cover-up of this panel of firms compared to the Intermediate Census of Industry of 1996, is around 45% of the food industry. Generally the average dimension in the almost all food sub-sectors for the firms, result three or four times greater than the Census data

The data utilised to analyse in deep the meat and fruit and vegetables sectors are panel of firms derived from the general level data bank are manufacturer industries. From the more than 3,800 hectares sheets belonging to the food industry, for the years 1996-1999, we have selected the firms belonging to meat and fruit and vegetables. A closer examination for the meat sub-sectors of the Italian provinces is given by the study of the balance sheets of a panel of 446 meat processing firms (minimum turnover: 2 billion lire), which were active in Italy between 1996 and 1999. In 1999, total employees were 24,018, chiefly concentrated in the larger firms (15,532 employees).
For the analysis of fruit and vegetable industry we considered a panel of 227 firms in 3 years (1996 to 1998). The smaller firms (< 20 employees) are numerous (50% of firms but with only 8% of employees). The higher number of employees (62%) are in the large firms (8,392).

4.2 Efficiency of Firms in Meat Districts

In the past few years, a fairly considerable number of studies, based on balance sheet data, have evidenced a clear 'district effect' on the return ratios of firms (Fabiani S., Pellegrini G. 1998, Fabiani S., Pellegrini G., Romagnano E., Signorini L.F. 1998, Signorini L.F. 1994).[2] On the basis of these findings, we estimated a stochastic frontier production function with a view to assessing the 'district effect' affecting two meat districts and also two fruit & vegetables districts (the latter being identified with the methodology described in Brasili C. et al.(1997).
In this section, we will report the results of our study of the Parma/Reggio Emilia and San Daniele ham-producing districts. These districts are economically important within Italy's agri-food industry and epitomise the *made-in-Italy* brand, increasingly popular both in Italy and abroad (Becattini, 1998). In the next few paragraphs, we will see that the two districts - although both (mainly) ham production areas - showed strikingly different structural and economic features. The districts' importance and differences are presented in previous works (Brasili, Ricci-Maccarini 2002).
The first step of our analysis consisted in building a balanced panel of firms (446) in the meat sector for the 4 years going from 1996 to 1999. We classified them as follows: non-district firms (306); firms in the Parma and Reggio Emilia district (60); meat sector firms in the San Daniele district (10); firms in other Italian districts (70). A total of 446 firms were included in the panel for the 4 years; data to estimate the stochastic frontier production function and for efficiency analysis were available for all.
We calculated some (median) ratios for each of the groups identified above. Now, we will review some financial characteristics of the meat firms belonging to these groups, in order to determine whether there was a “district” effect, before analysing their technical efficiency. For this purpose, we will rely on some of the more frequently used ratios, deriving from the balance sheets of the subset identified by the meat sector firms.
Parma and Reggio Emilia and San Daniele meat processing districts generally showed higher return ratios. In fact, the two districts had a ROI higher than 6% in almost all the years considered (except for the ROI of the Parma and Reggio Emilia district in the year 1999), while all the other districts (less characterised than the first two) and the non-district firms had ROI values lower than 6% (Table 4.4 in app.). Generally, the ROE value was less clearly higher in the districts even if, in non-district firms, it never exceeded 3%, whereas the Parma, Reggio Emilia and San Daniele districts it was lower than 3 only once, in 1996 (in San Daniele). Based on other studies conducted on Italian districts (Signorini 1994, Fabiani S., Pellegrini G. 1998), we confirm the higher return ratios for the firms localised in the districts.

[2] These analyses covered the main manufacturing sectors, including the food one. The latter was no exception, and the return ratios (ROI and ROE) of district firms were sharply higher than those of non-district ones (Fabiani S. et al. 1998).

Labour productivity was much higher in the Parma and Reggio Emilia and San Daniele district firms (over 30-40 million Italian lira per employee) than in the firms localised in the other districts and for the non-district firms.
In line with Signorini's results, labour costs were also a few millions higher in district firms because of generally higher salaries; this was true in particular of the Parma and Reggio Emilia district. However, this value was more than offset by higher labour productivity.
The last variable considered was the debt ratio, that generally turned out to be lower in the districts. However, they displayed lesser recourse to external financial resources.
Our target was to identify the existence of a 'district effect' in terms of efficiency for the meat processing firms included in the panel previously studied from a financial viewpoint. To this end, an estimation of a stochastic frontier production function was used in conjunction with an estimation of individual fixed effects relative to meat processing firms alone, both district and non-district. A positive 'district effect' was equivalent to a reduction of a firm's technical inefficiency.

Table 4.3 Meat Processing Panel

	Firms				Employees			
	1999	**1998**	**1997**	**1996**	**1999**	**1998**	**1997**	**1996**
Parma and R. Emilia District	60	60	60	60	1,185	1,278	1,242	1,205
San Daniele District	10	10	10	10	176	185	177	169
Other meat districts	306	306	306	306	7,192	6,889	6,499	6,262
Other meat firms	70	70	70	70	15,465	15,823	14,928	15,657
Total	**446**	**446**	**446**	**446**	**24,018**	**24,175**	**22,846**	**23,293**

Source: our processing of Cerved data

To achieve this target, we employed a parametric methodology already used in previous research carried out in other sectors of the processing industry (Fabiani S. *et al.* 1998; Fabiani S. and Pellegrini G. 1998; Signorini L.F. 1994). For the utilisation of the parametric-type functions, the reader is referred to Fabiani S., Pellegrini G., Romagnano E., Signorini L.F. (1998), whose conclusions we share.
Thus, our application covered the meat processing industry, more specifically 446 firms in the years 1996, 1997, 1998 and 1999 (that we have already analysed from a financial and dimensional point of view in the previous Section).
The above-mentioned stochastic frontier production function was estimated for these firms as follows:

(1) $\ln(Y_{it}) = \beta_0 + \beta_1 trend + \beta_2 \ln(L_{it}) + \beta_3 \ln(K_{it}) + (v_{it} - u_{it})$

where Y_{it} is the value added of the *i*-th firm at time *t;* L_{it} the *i*-th firm's number of employees at time *t;* κ_{it} is the value of net tangible assets of the i-th firm at time t; v_{it} is a random variable independently and identically distributed according to a normal with null medium and σ_v^2 variance. v_{it} is assumed to be non-correlated with regressors and technical coefficients. The effect due to technical inefficiency u_{it} is specified as follows:

(2)

$$u_{it} = \delta_0 + \delta_1(\text{PR - RE distr.}_i) + \delta_2(\text{San Daniele distr.}_i) + \delta_3(\text{Other Meat distrs}_i) + \delta_4(< 20 empl._i) + \delta_5(20-100 empl.) + \delta_6(NE_i) + \delta_7(NW_i) + \delta_8(Centre_i) + \delta_9(TecInnInd_i) + \omega_{it}$$

where ω_{it} are non-negative random variables measuring technical inefficiency and assumed to be independently distributed along a truncated normal $N(m_{it}, \sigma_u^2)$, where $m_{it} = z_{it}\delta$ and where z_{it} is the vector of 9 explanatory variables which - in our opinion - may affect the technical efficiency of the firm in equation (2) and the coefficients δ are parameters to be estimated[3];

[3] Simultaneous maximum likelihood estimates for the parameters in equations (1) and (2) were made with Version 4.1 of the FRONTIER program by Tim Coelli of New England University.

where δ_1, δ_2 and δ_3 are the coefficients of the dummies that refer to district localisation, while δ_4 and δ_5 are the coefficients relative to the dimension of the firms. The three dummies δ_6, δ_7 and δ_8 represent the geographic localisation of the firms in Italy. Finally, δ_9 is the coefficient of the index that we chose as proxy of technical innovation (in particular it is not an investment in tangible assets).

The coefficient of the district variable was significant and of the expected sign for firms in the Parma and Reggio Emilia district (about -0.9) with respect to those not included in the meat districts; moreover, it had the expected sign but a much lower absolute value in the other districts (-0.5 in the San Daniele meat district and -0.2 in the other meat districts, Table 4.5).

Size class and geographic location were other distinctive factors in the efficiency of meat industry firms, but in an opposite way. Inefficiency was higher in small firms, roughly 2 times the one of larger firms. Moreover, the fact of belonging to North West, North East and Centre geographic areas is a factor of decreased inefficiency vs. belonging to the South of Italy (more than -0.2). Lastly, we introduced the variable of technological innovation; the coefficient had the expected sign (-0.43), denoting reduction of inefficiency, but it was not significant.

This analysis broadly confirmed our previous results, but two important differences should be emphasised. In the meat sector, the 'district effect' remained strong and significant in Parma and Reggio Emilia, while it was less relevant in the other districts. Size was another factor: for the meat sector alone, larger firms stood out as being more efficient.

Moreover, we have considered the median value of the efficiency in the four years for the groups of firms specified (table 4.6 and figure 4.1). It is clear the higher values in the district of Parma and Reggio Emilia but also relevant differences there are (only a few lower than in Parma and Reggio Emilia district) in the case of San Daniele district respect to the other meat districts and other meat firms. The values in the years are enough steady but we may observe a small increase in the efficiency of San Daniele district.

Table 4.5 Stochastic Frontier Production Function and Technical Efficiency Parameters for Meat Processing Firms (1996-1999)

	Coefficient	Standard error	t-statistic	
β_0	**4.51**	0.08	58.39	**
β_1	**0.02**	0.01	2.71	**
β_2	**0.66**	0.01	46.03	**
β_3	**0.19**	0.01	20.20	**
δ_0	**-1.29**	0.39	-3.30	**
δ_1	**-0.87**	0.16	-5.31	**
δ_2	**-0.52**	0.18	-2.85	**
δ_3	**-0.22**	0.08	-2.85	**
δ_4	**2.04**	0.40	5.08	**
δ_5	**1.89**	0.40	4.74	**
δ_6	**-0.26**	0.06	-4.35	**
δ_7	**-0.28**	0.06	-4.46	**
δ_8	**-0.23**	0.06	-3.59	**
δ_9	**-0.43**	0.45	-0.95	
γ	**0.42**	0.05	8.93	**

Source: our processing of Cerved data

*** significant for $t_{0.05}$=1.645 ** significant for $t_{0.025}$=1.960**

$$\ln(Y_{it}) = \beta_0 + \beta_1 trend + \beta_2 \ln(L_{it}) + \beta_3 \ln(K_{it}) + (v_{it} - u_{it})$$

$$u_{it} = \delta_0 + \delta_1(\text{PR - RE distr.}_i) + \delta_2(\text{San Daniele distr.}_i) + \delta_3(\text{Other Meat distrs}_i) + \delta_4(< 20empl._i) + \delta_5(20-100empl.) + \delta_6(NE_i) + \delta_7(NW_i) + \delta_8(Centre_i) + \delta_9(TecInnInd_i) + \omega_{it}$$

$$\gamma = \sigma^2{}_u \Big/ (\sigma_u^2 + \sigma_v^2)$$

Table 4.6 Median Efficiency In the Meat Groups Firms

	1996	1997	1998	1999
Parma and R. Emilia Distr.	0.887	0.894	0.885	0.890
S.Daniele District	0.825	0.822	0.815	0.830
Other Meat Districts	0.783	0.783	0.793	0.783
Other meat Firms	0.648	0.649	0.647	0.651

Source: our processing of Cerved data

4.3 Efficiency of Firms in Fruit & Vegetables Districts

It was more difficult to analyse the district areas in the fruit & vegetables sector, for two main reasons. The first is that, in the past few years, a restructuring (in some cases downsizing) process has taken place in the most relevant area of fruit & vegetables production, that is the Romagna area (Emilia-Romagna region). Therefore, we had some difficulties in tracking the firms of the panel over several years, because some of them closed down and others set up joint ventures. The second reason is that this sector has less typical products than the meat processing one and thus it is less characterised in terms of district localisation and of *made-in-Italy* production. We attempted to analyse the fruit & vegetables processing sector in the same way as the meat processing one, bearing in mind the two above-mentioned problems.

We focused our analysis on two district areas, namely the Romagna area (specialised in processing of fruit, e.g. peaches, apricots and pears) and the Salerno area (Campania region, specialised in vegetables, especially tomatoes)

In our study, we considered 4 groups of firms (Table 4.7). The two most important areas identified through the Census data were: the area of the Romagna provinces with high concentration and specialisation in fruit processing (called "Romagna district") and the processing and preservation establishments in the provinces of Salerno and Naples (called "Salerno district").

We considered he other district areas and all the other firms not localised in the district municipalities as a whole.

The firms in the Romagna district were only 9 and, in 1998, their employees decreased to 700 from roughly 1000 in the year before, revealing signs of crisis.

In the Salerno district, there were 37 firms and, in the two years, employees declined from 2,289 (1996) to 2,000 (1998). In the 53 other district firms, there were 2,811 employees in 1998. Employees rose only in the non-district firms, from 5,236 (1996) to 7,728 (1998).

Table 4.7 Panel of Fruit & Vegetables Processing Firms

	Firms			Employees		
	1998	**1997**	**1996**	**1998**	**1997**	**1996**
Romagna	9	9	9	949	1,058	723
Salerno	37	37	37	1,997	2,531	2,289
Other districts	53	53	53	2,811	2,624	2,909
Other fruit & vegetables firms	128	128	128	7,728	7,153	5,236
Total	**227**	**227**	**227**	**13,485**	**13,366**	**11,157**

Source: our processing of Cerved data

The ROI was about 5% in 1998 and in 1997 and about 8% only in 1996. Conversely, in the Salerno district, the ROI had the same trend but with values much lower than in the Romagna district and as against the other groups (table 4.8 in app.). Also the ROE was much higher in the Romagna district (except in 1997) than in all the other groups of firms considered. These findings showed that return ratios were clearly higher in the Romagna district than in all the other groups which had experienced some difficulties in 1997.

With regard to labour productivity, the lowest values were observed in the Salerno district (about 67 millions per employee in 1998), while the Romagna one displayed the highest value (about 96 millions per employee).By contrast, the labour cost per employee was almost the same in each group, the difference being roughly 3 millions in each year considered (except in the Romagna district in 1996, i.e. about 75 millions).
The debt ratio had the lowest values in the Romagna district in all the years considered. Actually, in the Romagna district, it was lower than that of the other groups (in the range of 2 or 3 percentage points) and of the Salerno district (4 percentage points).
This first analysis gave evidence of a "district effect" for the Romagna district and stronger evidence of a restructuring process in the firms belonging to the fruit & vegetables sector.
In the second stage of the analysis, we verified the "district effect" in terms of reduction of technical inefficiency due to localisation of the firm in a district area. As in the case of the meat sector, we estimated a stochastic frontier production function using the same methodology. In this case, our application covered the fruit & vegetables processing industry, namely 227 firms in the years 1996, 1997 and 1998.
The above-mentioned stochastic frontier production function was estimated for these firms as follows:

(3) $\ln(Y_{it}) = \beta_0 + \beta_1 trend + \beta_2 \ln(L_{it}) + \beta_3 \ln(K_{it}) + (v_{it} - u_{it})$

Equation (3) is as specified in the above Section: Y_{it} is the value added of the *i*-th firm at time *t;* L_{it} the *i*-th firm's number of employees at time *t;* κ_{it} is the value of net tangible assets of the i-th firm at time t; v_{it} is a random variable independently and identically distributed according to a normal with null medium and σ_v^2 variance. v_{it} is assumed to be non- correlated with regressors and technical coefficients. The effect due to technical inefficiency u_{it} is specified as follows:

(4)

$$u_{it} = \delta_0 + \delta_1(\text{Romagna distr.}_i) + \delta_2(\text{Salerno distr.}_i) + \delta_3(\text{Other Fr.-Veg. distrs}_i) + \delta_4(< 20 empl._i) + \delta_5(20-100 empl.) + \delta_6(NE_i) + \delta_7(NW_i) + \delta_8(Centre_i) + \delta_9(TecInnInd_i) + \omega_{it}$$

where ω_{it} are non-negative random variables measuring technical inefficiency and assumed to be independently distributed along a truncated normal $N(m_{it}, \sigma_u^2)$, where $m_{it} = z_{it}\delta$ and where z_{it} is the vector of 9 explanatory variables which - in our opinion - may affect the technical efficiency of the firm in equation (4), and the coefficients δ are parameters to be estimated. Moreover, δ_1, δ_2 and δ_3 are the coefficients of the dummies that define localisation in the district, while δ_4 and δ_5 are the coefficients relative to the dimension of the firms. The three dummies δ_6, δ_7 and δ_8 represent the geographic localisation of the firms in Italy. Finally, δ_9 is the coefficient of the index that we chose as proxy of technical innovation (in particular it is a variable that shows "investment in intangible assets").
All the district variables were not significant, but all of the expected sign (in terms of inefficiency reduction) with respect to the firms not included in the fruit & vegetables districts (Table 4.9). The dummies relative to the size of the firms showed negative coefficients (reduction of inefficiency), but higher for the smallest firms (up to 20 employees) and significant (-0.9).
The dummies relative to geographic location were other distinctive factors. Efficiency was higher in the firms belonging to the Centre (-0.8) and to the North West (-0.4) and also significant, albeit to a lesser extent, in the North East (-0.2) of Italy, as compared with those belonging to the South of Italy (more than -0.2).
Lastly, after introducing the variable relative to technological innovation, the coefficient proved to be positive, but not in terms of reduction of inefficiency, and not significant.

This analysis confirmed that in the fruit & vegetables sector, there was a very small "district effect", i.e. an increase in the technical efficiency of the firms localised in the districts. In particular, this effect was smaller in comparison with the same analysis conducted on the meat sector. This was also true of the two most specialised areas of production, i.e. Romagna and Salerno. However, there were some important factors of differentiation in favour of the Romagna district; in fact, it recorded higher return ratios and a sharply higher productivity of labour.
Moreover the analysis of the median efficiency in the two districts considered and in the other districts shows that the highest efficiency is in the three years in the local system of Romagna district while the lowest is in the local system of Salerno, confirming the deep differences inside the firms in the sector of Fruit & Vegetables production (table 4.9 in app.)

$$\ln(Y_{it}) = \beta_0 + \beta_1 trend + \beta_2 \ln(L_{it}) + \beta_3 \ln(K_{it}) + (v_{it} - u_{it})$$

$$u_{it} = \delta_0 + \delta_1(\text{Romagna distr.}_i) + \delta_2(\text{Salerno distr.}_i) + \delta_3(\text{Other Fr.-Veg. distrs}_i) + \delta_4(< 20 empl._i) + \delta_5(20-100 empl.) + \delta_6(NE_i) + \delta_7(NW_i) + \delta_8(Centre_i) + \delta_9(TecInnInd_i) + \omega_{it}$$

$$\gamma = \sigma^2_u \big/ (\sigma^2_u + \sigma^2_v)$$

*** significant for $t_{0.05}$=1.645 ** significant for $t_{0.025}$=1.960**

Table. 4.10 Median Efficiency in the Fruit & Vegetables Firms

	1996	1997	1998
Romagna	0.882	0.880	0.886
Salerno	0.684	0.692	0.699
Others Districts	0.820	0.825	0.818
Others F. & V. firms	0.823	0.822	0.813
Total	0.807	0.800	0.798

Source: our processing of Cerved data

5 Concluding Remarks

The food industry has a wide geographic coverage in Italy, but profound differences remain between the North and South. Wide geographic coverage of the food industry is associated with strong geographic concentration and specialisation.
The results from the economic and financial analysis of the balance sheets of firms, the two sub-sectors (meat processing and fruit & vegetables) per size classes are very interesting.
The economic and financial analysis has been done clustering the firms of the panel into different group belonging or not at specific food districts. The analysis show better results for firms inside the local systems especially for the meat industry. The economic and financial results are better for the district. The district of Parma is better respect to San Daniele and other meat district. In the fruit and vegetable the better results are in the district of Romagna.
The estimation of efficiency of firms done with the stochastic frontier production function for the meat processing firms in the panel validates our previous results on "district effect". But two important differences are to be pointed out. In the meat sector, the 'district effect' remains strong and significant in Parma and Reggio Emilia, while it is less relevant in the other districts. The size is another factor of efficiency in the meat sector only with larger firms stand out as being more efficient
As to the fruit & vegetables sector, we observed a very low "district effect". In particular, this effect is smaller in comparison with the same analysis conducted for the meat sector. This is also true of the two most specialised areas of production (Romagna and Salerno). Nevertheless, there are some important factors of differentiation in favour of the Romagna district: higher return ratios and definitely higher productivity of labour.
In conclusion, the features that characterise and differentiate the complex reality of the Italian food industry are not only geographic localisation and specialisation of the different sectors, but also the fact of belonging to local systems or industrial districts.

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Appendix

Table 4.4 Meat Sector Districts and Firms: Some Balance Sheet Ratios (median)

	1999	1998	1997	1996
R O I (%)				
Parma and R. Emilia	4.4	6.3	7.0	7.0
S. Daniele	7.0	7.0	6.7	6.7
Other meat districts	4.4	6.0	5.3	5.7
Other meat firms	4.6	5.5	4.8	5.0
Total	4.6	5.6	5.1	5.4
R O E (%)				
Parma and R. Emilia	3.4	5.5	6.6	3.8
S. Daniele	7.4	4.5	3.5	2.8
Other meat districts	2.6	3.8	4.1	4.2
Other meat firms	2.6	2.9	2.8	2.6
Total	2.8	3.4	3.4	2.9
Labour productivity (millions per employee)				
Parma and R. Emilia	136.5	138.9	138.2	127.8
S. Daniele	133.2	129.3	122.8	128.2
Other meat districts	97.8	95.0	93.1	90.4
Other meat firms	97.9	90.7	91.3	87.9
Total	102.5	97.9	97.7	94.6
Labour cost per employee (millions)				
Parma and R. Emilia	66.9	56.9	65.2	62.7
S. Daniele	55.4	50.8	54.4	54.6
Other meat districts	55.7	52.7	55.3	55.1
Other meat firms	54.2	50.1	53.0	51.4
Total	55.6	51.0	54.6	53.6
Debt ratio (%)				
Parma and R. Emilia	3.9	3.9	3.7	3.7
S. Daniele	2.1	2.1	2.4	2.6
Other meat districts	5.7	5.5	5.3	5.4
Other meat firms	5.9	6.0	6.2	6.1
Total	5.6	5.5	5.5	5.6

Source: our processing of Cerved data

Table 4.8 Fruit & Vegetables Sector Districts and Firms: Some Balance Sheet Ratios (median)

	1998	1997	1996
R O I (%)			
Romagna	5.5	4.7	8.2
Salerno	2.7	1.5	3.5
Other F. & V. districts	4.6	4.3	5.2
Other F. & V firms	4.3	4.2	4.8
Total	4.2	3.9	4.6
R O E (%)			
Romagna	5.7	0.3	6.8
Salerno	2.8	1.4	2.2
Other F. & V. districts	2.7	1.8	4.0
Other F. & V firms	1.5	3.3	6.1
Total	2.4	2.5	4.3
Labour productivity per employee (millions)			
Romagna	96.5	75.2	103.6
Salerno	67.6	61.9	55.8
Other F. & V. districts	81.5	86.3	84.8
Other F. & V firms	78.1	84.0	81.8
Total	80.0	81.0	80.3
Labour cost per employee (millions)			
Romagna	50.3	49.0	75.8

Salerno	47.0	47.5	45.1
Other F. & V. districts	49.1	47.5	50.6
Other F. & V firms	50.2	50.2	51.3
Total	49.4	48.9	50.4
Debt ratio (%)			
Romagna	3.5	2.8	2.3
Salerno	5.9	7.1	7.0
Other F. & V. districts	5.9	6.0	5.4
Other F. & V firms	5.3	5.3	5.3
Total	5.4	5.7	5.4

Source: our processing of Cerved data

Table 4.9 Stochastic Frontier Production Function and Technical Efficiency Parameters for Fruit & Vegetables Processing Firms (1996-1998)

	Coefficient	**Standard error**	**t-statistic**	
β_0	**3.73**	0.09	40.82	**
β_1	**0.01**	0.02	0.44	
β_2	**0.59**	0.02	40.82	**
β_3	**0.30**	0.02	24.38	**
δ_0	**0.57**	0.18	3.22	**
δ_1	**-0.12**	0.71	-0.17	
δ_2	**-0.24**	0.15	-1.53	
δ_3	**-0.20**	0.14	-1.46	
δ_4	**-0.89**	0.31	-2.87	**
δ_5	**-0.22**	0.16	-1.35	
δ_6	**-0.40**	0.50	-8.11	**
δ_7	**-0.22**	0.70	-3.18	**
δ_8	**-0.77**	0.31	-2.48	**
δ_9	**1.21**	0.98	1.23	
γ	**0.60**	0.09	6.65	**

Source: our processing of Cerved data