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# **A Comparative Analysis of the Meat Sector in Hungary and Emilia-Romagna: Performance and Efficiency**

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## Abstract

In the last years, a lot of important changes occurred inside the European Union after the entering of 12 new member States. The rate of economic growth of the new member States has been higher than the other EU members. In Hungary, particularly, the growth level has reached an intermediate position, placing itself at 4% GDP per capita. Comparative analysis are needed to better understand the process of catching-up and to evaluate how the integration between EU regions and countries is going on.

The aim of this paper is to compare the economic and efficiency performance of firms in Hungary and Emilia-Romagna, considering a specific sector, meat processing and storage, of the food industry). We will investigate if in the last years the integration process has ultimately led to narrow the gap in the economic performances and efficiency of the firms. The choice of meat processing industry is due to the fact that in Hungary there's a remarkable animal production, whereas in the Emilia-Romagna region the meat industry reflects an organizational structure based on the concentration and specialization in agri-food 'districts'.

This paper compares the financial-economic performances and the technical efficiency of firms involved in the industry of meat processing in Hungary and in an Italian region, Emilia-Romagna. We will also discuss and compare the different results obtained throughout governance and structure of meat industry. We will underline the main role of the "industrial districts" in Emilia-Romagna, and how the Hungarian entrepreneurial system could handle the competition in the global market.

**Keywords:** Firms financial-economic performances, stochastic production function, agri-food districts, meat processing industry, Hungarian and Emilia-Romagna food industry

## 1. INTRODUCTION

Since the system changed, in 1989, the production structure in the Central and Eastern European Countries (CEEs) has been modified during the transition process involving the economical but also political and social aspects. Two main features of these changes were market liberalization and privatization of state firms, in order to get a sound macroeconomic equilibrium. Hungary has been considered, among the twelve European Union (EU) new Member States, the best performer, together with Estonia, in leading on these reforms. The main reformers among CEEs and CIS showed a U trend for GDP and employment. The inevitable backlash of market reform has been the drop in agricultural production: output drops in most countries have ranged from 25 to 50 percent and the livestock sector has particularly suffered the realignments occurring in the ownership and the problems of competitiveness.

Also in the meat production and processing sectors, where the privatization has been completed with a lot of foreign investors entered the business, there has been a drop of production. The meat output in Hungary for the period 1997-1999 ranged the 65% of the meat output in the period 1986-90. In 2005, almost 80% of food industry are micro-enterprises with less than 10 employees, and that of less than 50 employees account for more than 95% of food firms.

The other inevitable consequence of market reforms was the creation of a high unemployment level in which the worst off resulted women, old workers and those ones who live in disadvantaged areas (the mainly agricultural Northern and Southern Great Plain in Hungary)

and who haven't been able to reconvert their working abilities, whereas new private and privatized firms haven't provided for the expected job places. In 1994, agriculture employed 14% of the labour force while in 2005 it stopped at 5%.

This structural changing, together with the new agricultural conditions established under the European Common Agricultural Policy, has also altered the degree of efficiency and competitiveness in the Hungarian meat sector<sup>1</sup>. In fact, before joining the EU only some products were competitive and efficient in private terms, as poultry, whose situation has improved after EU integration because agricultural policy conditions are more favourable under the CAP, while dairy and roast goose show a fall in production and weak competitiveness. The growth of FDI inflows and the technological progresses, introduced and augmented after the EU accession, haven't been able to support the competitiveness of the Hungarian food production and food processing industry on the world market, also because of the EU policies provide higher protection levels on food and requiring high productive and qualitative standards for farms and agro-food products.

In the same period, also agro-food industries in Emilia-Romagna have to face productivity and competitiveness problems. The main reasons are linked to the structure of the industry and in particular the size of the enterprises and to their serious problems and difficulties in the internationalisation<sup>2</sup>, In fact the numerous SMEs, representing the main productive reality in the agro-food sector, often organised in *districts*, with a strong geographical agglomeration of enterprises and with a strong specialization in specific food production, often of high quality and typical products.

In Emilia-Romagna the total value of the animal production is more than 1.5 billion Euro in 2006, a little less than half of total agricultural production. The total value of the meat production is more than 0,6 billion Euro, mainly pork, poultry and beef. In recent years, Moreover, a great negative impact had the epidemics (BSE and aviaries as firsts) on productions and consumptions whereas the media often created unjustified psychosis in consumers. An impressive example is the case of Emilia-Romagna where the poultry trend has been positive (due to the BSE crisis) till 2004, when it roughly stopped (and it also remains negative now)<sup>3</sup>.

In this paper we will evaluate and compare the growth process in the agro-food meat sector in Hungary and in the Emilia-Romagna region. In particular, we will first compare the financial and economic performances, and then we will estimate the technical efficiency of firms involved in the meat. The choice of this sector is due to the fact that in Hungary there's a remarkable animal production (more than 39 million heads<sup>4</sup> and around 1 million tons of meat production<sup>5</sup> in 2002), while the Emilia-Romagna region, who have also an important meat production and meat industry, shows an organizational structure based on the concentration and specialization of the SMEs in the agro-food districts. The Emilia-Romagna structure of meat industry is completely different from the Hungarian one, dominated by small-and often not contiguous-properties as a result of the Law on Restitution 1991 and the Law on Cooperatives Transformation 1993<sup>6</sup>.

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<sup>1</sup>If we consider that the main goal of the agricultural policy in the transition economies, and in Hungary as well, shouldn't have been the return to the pre-reform output levels but the increase in the productivity of input use

<sup>2</sup>In the current changing of the Italian food industry, big industrial groups could emerge (thanks to national and foreign direct investments). These enterprises (>50 employees) could better afford the crisis in the last period.

<sup>3</sup> Then, we must underline that the Region registered just few and isolated cases of infected animals.

<sup>4</sup> Hungarian Ministry of Agriculture and Rural Development, <http://fvm.hu/main.php?folderID=1287>

<sup>5</sup> Hungarian Central Statistical Office

<sup>6</sup>The original objective declared by the first liberal Government in Hungary was the 'unification of the principles of property and use of the land'.

The data utilised to compare the economic and financial results of meat enterprises of Hungary and Emilia-Romagna are represented by the balance sheets of the firms, included in the AMADEUS data bank (Bureau van Dijk), with financial and economic information about firms with more than 15 millions euro in terms of operative income for Germany, UK, France, Italy, Spain, Ukraine and Russian Federation; with more than 10 millions euro for the other firms. The budget analysis concerns with around 30 Hungarian firms and 30 firms from Emilia-Romagna in the period 2000-2006. Totally, the paper analyzes around 300 budgets of firms operating in the sector of meat transformation industry.

In the first part of the work we will compare the different economic performances using the most important economic and financial index (solvency ratio, profit margin, current ratio, labour productivity, etc.). In the second part, we will analyze the technical efficiency of firms involved in the meat industry on in Hungary and in Emilia-Romagna, utilising the stochastic production function. This methodology will allow us to evaluate the different efficiency degree between the two groups of firms and to determine the factors influencing efficiency. In the third and final part, we will discuss the main role of the industrial districts in Emilia-Romagna and how the Hungarian entrepreneurial system differ facing the competition in the enlarged European Union and in the global market.

## **2. THE FEATURES OF THE AGRO-FOOD SYSTEM IN HUNGARY AND IN EMILIA-ROMAGNA**

### **2.1 The Hungarian case**

In Hungary, as in the rest of the Central and Eastern European Countries before 1989, the agricultural production was fully integrated in the socialist planned economy, following different rules from market economies. Even though, Hungary was one of the few examples of successful agricultural collectivization (Swain, 1992): it reached a satisfactory level of agricultural self-sufficiency; export obtained good results and the whole system could provide enough food for the urban population. This system worked with a 'low' level of State subsidies, in comparison to the others CEEs. So, in 1980 the agricultural sectors figured as the second net contributor to the State budget<sup>7</sup>.

The agricultural and food sectors have been subjected to a great restructuring during the still on-going transition process. The privatizations opened the country at the penetration of foreign capitals (after 1989, Hungary was the State attracting the most of FDI in the CEEs area) that stimulated the creation of SMEs<sup>8</sup>. Foreign investments were pulled by the high quality of agricultural products, due to the productivity of land and the continental climate; by quite skilled and low cost workers; by a good level of food processing. Of course, also policy measures as reduction of taxation and low tariffs contributed to attract foreign investments.

In 2006, FDI in Hungary showed a growth of 3.6% with respect to 2005, while the number of firms owned by Hungarian decreased in favour to foreigners. Foreign property represents nowadays the 60% on the total. Thanks to these investments and to the European subsidies benefiting Hungarian farmers, the agro-food system could access to better productive technologies than the ones they got in the pre-transition years. But a lot of 'unexpected' problems emerged as a consequence of that restructuring: other than the fall down of production and employment (accompanied by an increase in the poverty level, specially in the

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<sup>7</sup>We must underline the low affordability of statistical data produced in the socialist period because they were more directed to legitimise the economic policies adopted than to give information about the reality of production. Liefert et al., 2002.

<sup>8</sup>The 50% of privatization incomes were originated by the selling of agro-food State enterprises.

countryside), the productive system experienced the destruction of social capital formed during the past period and the lack of professional figures (managers) able to reorganize firms and enterprises (Macours et al., 2000; Forgács 2006).

In Hungary, till 1989, agriculture generated 13.7% of GDP, and it employed 18% of labour force with more than 22% of export income. Instead, in 2005 agriculture contributed to 3% of GDP, it employed 5% of active population and it determined 6% of export, next to the levels registered in Emilia-Romagna. The number of people employed in agro-food industry was 4.1% on the national level and more than 16% of total workers in the manufacturing industry. In the same year, the sector obtained 2.7% of total investments in the total economy, 70% of which in machineries for technological modernization and 30% for technological endowment. Regarding trade, we must underline that, with the end of COMECON as privileged exchange area among CEEs, a reorientation in commercial flow has been necessary. Hungary was successful in that field: it's the only one, among the twelve new European Members, showing a positive trade balance in agriculture.

There are several differences between agro-food enterprises in Hungary and in Emilia-Romagna other than in the characteristics of products and in the technological equipment. The organizational and dimensional structure of firms are really different. As mentioned before, after the adoption of the Law on Restitution and the Law on the Transformation of Cooperatives (Liefert, 2002), introduced the privatization and to give the land back to the original owners, the current Hungarian farms are very small in dimensions. Also in Emilia-Romagna, there are a high number of small farms, but the Hungarian ones are less competitive. That's due to the problems linked to the distribution of properties (Swain, 1994), partly because of the fragmentation in small lots, of the unclear rules about the land rent for cooperatives and because of the problem of access to rural credit forms (required for the modernization of production structures). These lower competitiveness is linked to the difficulties of producers also in presenting the demands for financial support included in the new Rural Development Plans.

Today the Hungarian productive structure of agriculture is bipolar, where the number of small enterprises greatly exceeds the bigger ones. The 707,000 individual farms who contribute to the agricultural production today, as a consequence of the early '90s reforms, weren't able to stimulate the creation of medium enterprises. The last data given by the Hungarian Government show that 51.3% of farms (363,000) produces just for auto consumption; 33.1% (234,000) sells just what they don't consume; and only 15.5% (109,000) produces mainly for the market (not just for that); there are also a small number of farms (707) who offers services for agriculture.

Comparing meat production in Hungary and in Emilia Romagna we must consider that there's a great difference in the method used for the classification of production in the two case studies. In Hungary the raising of one pig in a year qualifies the activity as individual farm. It derives that breeding is the real purpose of those farms. In the last years, agriculture production prevailed over livestock in Hungary: in 2005, 75% of farms focalized on agricultural production, while 26% on animal production. Among individual farmers, 47% works in agriculture while just 20% is committed to livestock (mainly cattle and swine). In respect to 2004, in 2005 the number of swine, cattle and ovine decreased and also the diversification inside those categories. The same happened for animal products. The only slow growth in production were showed by ovine, while turkeys and goose stock recorded a great increase. The number of cattle was 700,000 in 2005, with a 6% decrease in the production of individual farms in the last year.

## **2.2 The agro-food industry in Emilia-Romagna**

Emilia Romagna is one of the most important regions in the Italian agro-food system and it's characterized by typical-well known, also abroad, high quality productions, as Prosciutto di Parma (meat sector) and Parmigiano-Reggiano (dairy sector). In 2005, the Region realized 21% of the total income of the Italian agro-food industry, with a value of export reaching 17% on the national level (Fanfani et al., 2006). The 2006 structural survey of the Emilia-Romagna evidences the presence of about 58,000 manufacturing enterprises, of which 9,249 in the food & beverages sector (16% of the total) with an increase of 12% in the last five years (Fanfani et al., 2007). The most relevant sectors are, meat processing industry with 1,106 firms (respectively 22% and 12% of the national and Emilia-Romagna regional total) and dairy with 1,537 enterprises (15% of the national and 16.9% of the Emilia-Romagna regional total).

The Emilia-Romagna region is characterized by the presence of several “districts” in the agro-food sectors or local systems of production, with a mosaic-like geographical distribution on the territory (Brasili et al., 2007). The origin, of these districts and local systems of production, is linked to the local type of development. In many cases, typical and traditions productions constituted the core for development, around which activities of processing and storage enlarge the market. In the last five years the number of food industry firms registered an increase of +10.1%, with 22% for meat and 15% of dairy enterprises on the national level. The employment level has also increased in 2005 (+1.4%) in comparison to 2004 but it shows a contraction of 7.8% of agricultural employed, higher than the national level (-4.3%).

Emilia-Romagna is one of the most open regions in term of export and import from the European union and the rest of the world. Emilia-Romagna is a net importer in the agri-food products. Regarding trade exchanges, in 2004 the agro-food regional deficit increased in respect with the national one (+10.6%), due to the increase in the import of agro-food products and a reduction in export, while in 2005 the trend changes. Those data reflects the fact that Emilia-Romagna is a net importer mainly of animals products<sup>9</sup> and also of meat products (+13.8% in 2005, about 31% of agro-food regional import). Instead, in 2005 there's a quite positive trend for dairy products and ice-creams, as an effect of the ongoing strengths put on the valorisation of regional cheese on foreign markets.

This picture of the regional economy shows the relevance of problems in some important sectors of the animal production, also because of the such as BSE and Poultry flue, causing a reduction in the cattle *filiere* already affected by a structural crisis of competitiveness. The ‘crazy cow’ scandal also represented a ‘rebirth’ of meat from autochthones caws because consumers are now able to spend +30% for a more certificated and guaranteed product. The aviarian flue led to a fall in the Italian and regional poultry producers, mainly because of the unjustified alarmism produced by media in the Italian consumers of poultry, of which Emilia-Romagna is a great producer (a quarter of national production). In the last years, decrease in production affected swine too, whereas environmental ties divert the production in other regions, mainly in Lombardia. Inside the Emilia-Romagna meat industry, the internationally most known product is “Prosciutto di Parma”: producers try to find other markets and promote guarantee actions to defend the first material till the identification of the final product. An important example is the constitution in Parma, at the end of 2005, of the ‘Gran Suino Padano Consortium’, composed by breeders and processing factories of what is known as the “heavy pig”. The task is to valorise, protect and control the denomination designing fresh meat coming from swine born, bred and slaughtered in Italy for the production of DOP

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<sup>9</sup>Other than France and Poland, from which the Region get respectively brotards and calves, in the next years it will be necessary to import animals from Brazil and Argentina, Countries pressing for the opening of EU barriers.

cold cuts, as “Prosciutto di Parma<sup>10</sup>”. Moreover, with the aim of diversifying the specific denomination of that famous product, the ‘Prosciutto di Parma Consortium’ subscribed an agreement with all the *filiere* representatives (breeders, slaughters, packagers) to start a qualitative-quantitative action to react to the difficulties of the division, namely sustaining the differential quality in order to justify a higher price (than the concurrency), in a not favourable economic phase in Italy.

### 3. The Economic and Structural Analysis of meat processing industry Enterprises

The enterprises selected from the AMADEUS data base (Bureau Van Dijk) concern the section “Production, processing and preserving of meat and meat products”, based on the 2002 ATECO classification. In order to assess the various economic and financial performances of Meat Processing Industry, we have analysed the balance sheets of about 70 enterprises over the six-year period 2000-2005. In Emilia-Romagna are located 45 of those enterprises and 25 in Hungary. The balance sheet data extracted from the AMADEUS data base (Bureau Van Dijk), contains financial information related to companies in Italy with over 15 million Euro sales or more than 200 employees, and enterprises in Hungary, with over 10-million-euro sales or more than 150 employees.

In Italy, the firms are mainly composed of big companies. In the period considered, the enterprises located in the Emilia-Romagna show a high and growing sales, ranging from 69.9 million Euro in 2000 to 77.5 million Euro in 2005. Even the cost of employee (6.31 million Euro) is higher respect to that of Hungarian enterprises.

In 2005, the total sales of the Hungarian enterprises considered are 29.5 million Euro with an increase, from 2000 to 2005, of 66.5%. Also the total cost of employee grown of 70% in the same period.

The analysis of the financial, structural, and income characteristics of the 70 enterprises has been conducted through the calculation of balance sheet standard indexes. In order to achieve a better evaluation of the realities analysed, we have used the index medians for the two groups of enterprises (Hungarian and Emilia-Romagna) and for each year considered (2000-2005)<sup>11</sup>. The indexes utilised and the result obtained are briefly described.

The **current ratio**, calculated as the ratio between availability (current activities) and current liabilities, indicates the enterprises’ ability to meet short-term debts with activities in the short run. If current liabilities exceed current assets (the current ratio is below 1), then the company may have problems meeting its short-term obligations. Both in Emilia-Romagna and in Hungary the current ratio is over one, then the enterprises have a good solvency level. In particular, in Emilia-Romagna the index increase from 1.03 in 2000 to 1.13 in 2005 (Table 1). The explanatory ability of this index is supported by the comparison with the **liquidity ratio** (liquidities/current liabilities), or quick ratio, which differs from the current ratio, in so far as stocks are excluded from the numerator (liquidities). The results highlight the important role of stocks for all the companies considered. As shown in the table, in fact, all the values of the liquidity ratio are lower than the current ratio.

Table 1 – Current ratio and liquidity ratio

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<sup>10</sup> The denomination has already got the official protection on the national level thanks to the decree law 5/9/2005.

<sup>11</sup> The choice of the median was determined by the necessity of referring to an indicator which would not be greatly affected by extreme values (rather frequent in this kind of analysis, especially if referring to countries under strong development, like Eastern Europe), but which would provide a good synthesis.



	<b>Current Ratio</b>					
	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
Emilia-R.	1.03	1.05	1.12	1.10	1.16	1.13
Hungary	1.00	1.13	1.04	1.05	0.84	0.91
	<b>Liquidity Ratio</b>					
	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
Emilia-R.	0.71	0.73	0.75	0.73	0.72	0.74
Hungary	0.71	0.76	0.76	0.73	0.61	0.55

Sources: our processing, AMADEUS data

A relevant figure is given by the importance of the stocks in the enterprises located in Emilia-Romagna. Furthermore, considering that the reference parameter based on which the company can be reckoned to have a good ability of immediate solvency is equal to 0.8, companies located in Emilia-Romagna converge to the reference parameter, whereas for the enterprises of Hungary it is declining.

The **shareholders liquidity ratio** (shareholders funds/medium-long term liability) expresses the enterprises' ability to meet long-term liabilities with their own capital. In the six years considered, the enterprises' capital solidity varies considerably. The enterprises in Emilia-Romagna remain essentially steady, with values slightly above the unit. Enterprises in Hungary, instead, show a high ratio, with a maximum of 7.44 in 2002 (Table 2).

Table 2 – Shareholders liquidity ratio and solvency ratio

	<b>Shareholders Liquidity Ratio</b>					
	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
Emilia-R.	1.48	1.44	1.67	1.36	0.96	1.06
Hungary	4.74	4.77	7.44	4.04	3.10	3.64
	<b>Solvency Ratio (%)</b>					
	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
Emilia-R.	14.03	14.43	14.96	17.47	19.01	15.95
Hungary	38.38	42.98	41.83	38.98	30.91	33.58

Sources: our processing, AMADEUS data

The **solvency ratio** (shareholders funds/total assets %), helps evaluate the companies' effective capitalization percentage. Enterprises in Emilia-Romagna show the lowest level of activity capitalization, even with an increase up to 19% in 2004 and to a lower value of 16 in 2005 (Table 2). In Hungary, instead, the solvency ratio is much higher but with a downward trend, from 42.98% in 2001 to 33.58% in 2005.

The analysis of the long-run financial balance, the **coverage rate of the fixed assets with the owner's equity** (fixed assets/shareholders funds) is greater than one, for the companies located in Emilia-Romagna, then the fixed assets are not covered by the shareholders funds. Also for the Hungarian enterprises the index is greater than the coverage rate of fixed assets with the owner's equity, but it varies considerably in the period considered (Table 3).

The **profit margin** (Net Income/Net Sales Revenue %) is an indicator of a company's pricing policies and its ability to control costs. In the six years considered, the enterprises' capital solidity varies considerably. The enterprises in Emilia-Romagna remain essentially steady with values slightly above the unit. Enterprises in Hungary, instead, show a positive ratio and greater ratio (Table 3).

Table 3 – Coverage rate of fixed assets with the owner's equity and Profit margin (%)

	<b>Coverage rate of fixed assets with the owner's equity</b>
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	2000	2001	2002	2003	2004	2005
Emilia-R.	1.70	1.81	1.60	1.31	1.32	1.38
Hungary	1.11	0.92	1.18	1.28	1.53	1.60
Profit margin (%)						
	2000	2001	2002	2003	2004	2005
Emilia-R.	0.98	1.11	1.14	1.00	1.23	0.99
Hungary	2.49	2.22	1.89	1.48	1.17	1.57

Sources: our processing, AMADEUS data

The **return on shareholders funds** (Profit or loss before taxation/shareholders funds %) indicates the profitability of shareholders funds before taxation. The analysis of the results of this index confirms better situation for the Hungarian companies, respect to that of Emilia-Romagna (Table 4). In both cases the index shows a considerable decline.

The **return on total assets** (Operating profit loss/Total assets %), indicating the profitability of the capital invested, also confirms the positive tendency noticed in the return on shareholders funds for companies in Hungary, even if it is declining. The enterprises in Emilia-Romagna show a lower profitability with 1,25% return on total assets in 2005, against 2,95 in Hungary (Table 4).

Table 4 – Coverage rate of fixed assets with the owner’s equity and Profit margin (%)

	Return on Shareholders Funds (%)					
	2000	2001	2002	2003	2004	2005
Emilia-R.	11.01	11.97	10.24	9.54	8.94	7.41
Hungary	17.45	16.32	16.50	9.82	6.74	13.00
Return on Total Assets (%)						
	2000	2001	2002	2003	2004	2005
Emilia-R.	1.74	1.45	1.28	1.22	1.34	1.25
Hungary	6.55	7.11	4.10	2.26	1.88	2.95

Sources: our processing, AMADEUS data

The overall analysis of balance sheet financial and economic indexes emphasises that the enterprises of the Hungary show a good solvency situation, a shareholders fund situation characterized by a good balance between owner’s capital and external financial support, and an high level of profitability, The situation in Emilia-Romagna is characterized by poor short-term solvency, low level of activity capitalization, and consequently a high recourse to third parties’ capital, accompanied with low profitability in every year analysed.

## 4. Companies’ Technical Efficiency

### 4.1 The empirical model

The analysis of production efficiency originates from the seminal works of Debreu (1951), Koopmans (1951) and Farrel (1957). Oriented output or oriented input can be considered as a measure of production efficiency. In the former case, it indicates the ability of a decision making unit to produce the maximum output, given a fixed input set; in the latter, it shows the aptitude to produce a given output with a smaller input quantity.

Production efficiency can be measured by means of parametric or non-parametric methods. The latter methods essentially consist in linear planning techniques; they have the advantage

of not requiring the imposition to the data of any functional form, as they consist of optimisation algorithms. Because no error term is present, they do not allow specifying statistic tests, and every distance from the production frontier can be always associated with efficiency and not with measurement errors. The most commonly used non-parametric methods include the Free Disposal Hull (Deprins, Simar, Tulkens, 1984), and the Data Envelopment Analysis (Charnes A., Cooper W.W., Rhodes E., 1978).

Parametric methods come from the work of Aigner, Lovell and Schmidt (1977), as well as Meeusen and Van den Broeck (1977), who independently proposed production stochastic frontiers. These methods imply the assumption of a functional form representing production or cost structure. The advantage of the econometric approach is the presence of an error term allowing the distinction between measure and efficiency errors, and the specification of statistic tests. The problems of parametric methods concern the necessary strong assumptions about the functional form, and the distribution of the error term.

In recent years, various models have been proposed, to analyse cross-section data, panel data, time varying models, with individual effects, etc. Here follows a general formulation of the stochastic frontier model:

$$y_{it} = f(x_{it}; \beta) \cdot \exp(v_{it} - u_{it})$$

where  $x_{it}$  is an input matrix,  $y_{it}$  is an output vector ( $i=1,2,\dots$  number of firms and  $t=1,2,\dots T$ ),  $f(\cdot)$  is the function defining the production frontier,  $\beta$  is the vector of the technology parameters,  $v_{it}$  is a random error, which includes the variability due to events that cannot be controlled by the firm and measurement errors, and  $u_{it}$  is a variable that is assumed to represent the enterprise technical inefficiency. Commonly, it is assumed that  $v_{it}$  is independently and identically distributed as a  $N(0, \sigma_v^2)$ , and that  $u_{it}$  is distributed independently of  $v_{it}$  as  $|N(0, \sigma_u^2)|$ .

In this paper, we have chosen to use the model proposed by Battese and Coelli (1995), where the component  $u_{it}$  is expressed as a function of social and economic variables that affect the enterprise inefficiency.

The model analysed also helps calculate the efficiency of each enterprise by means of the following simple function:

$$EFF_i = \exp(-u_i)$$

## 4.2 Technical efficiency for Production of meat industry

The analysis of technical efficiency of enterprises of meat industry, focuses on the variables liable to affect their efficiency of the two groups located in Emilia-Romagna and Hungary. In the analysis we utilise the stochastic frontier translog production function model, involving two inputs, capital and labour, and one explanatory variable for the inefficiency effects in the stochastic frontier (firms located in Hungary or in Emilia-Romagna).

The maximum likelihood (ML) estimates of the model were obtained using FRONTIER 4.1 (Coelli 1996). The program itself follows a three-step procedure. OLS are first obtained, followed a grid search that evaluates a likelihood function for values of  $\gamma$  between zero e one, with adjustments to OLS estimates of  $\beta_0$  and  $\sigma^2$ . All other values of  $\beta$  are restricted to be zero in this step. Finally, the a quasi-Newton iterative procedure to form ML estimates at a point where the likelihood function obtains its global maximum.

The Cobb-Douglas production function is found to be adequate representation of the data, given the specifications of the translog frontier model. Hence, equation for the balanced panel data set (2000-2006) is specified by a production function in Cobb-Douglas form:

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

$Y_{it}$  is the sales of the  $i$ -th firm at time  $t$  (th EUR);

$K_{it}$  the value tangible fixed assets of the  $i$ -th firm at time  $t$  (th EUR);

$L_{it}$  the  $i$ -th firm's cost of employees at time  $t$ ;

$\beta_k$   $k=0,1,2,3$  are unknown parameters for the production function;

$v_{it}$  are random variables associated with measurement errors or the combined effects of input variables not included in the production function. These terms are assumed to be iid  $N(0, \sigma_v^2)$ , and independent of the  $u_{it}$ ;

$u_{it}$  which are non-negative random variables which are assumed to account for technical inefficiency in production and are assumed to be independently distributed as truncations at zero of the  $N(m_{it}, \sigma_u^2)$  distribution; where:

$$m_{it} = \delta_0 + \delta_1(\text{Hungary})$$

In the specification of the model, we have also made hypotheses related to the error term. In particular, we have assumed that it consists of two parts, a random error and a function part of firm specific variables. To verify whether this assumption is correct, we have considered the test related to the presence of the component  $u_{it}$ . If the assumption does not bring significant information to the estimate, it can be eliminated and the model could be estimated by using OLS.

The null hypothesis that technical inefficiency effects are not present in the model is expressed by  $\gamma = \delta_i = 0$   $i=0 \dots 3$ . The value of the LR test is 34.4, which leads to the rejection of the null hypothesis. In fact, the reference value obtained by Kodde and Palm tables is 7.05; therefore, a significant part of the variables between companies is explained by the  $u_{it}$  component. Eventually, a test has been performed to verify whether the variables entered into the error term  $u_{it}$  are explanatory of the enterprises' inefficiency. The hypothesis tested is  $\delta_1 = 0$ , which yields a likelihood ratio test equal to 18.38, definitely higher than the  $\chi_1^2$  value (3.84); therefore, this null hypothesis is also rejected. The model (1) is a good specification of the data. The results for the estimated model are reported in table 5. The ML estimates of the coefficients of tree input variables and the explanatory variable in the inefficiency model have values which exceed their corresponding estimated standard errors except for the trend.

The analysis of the coefficients of the variables associated with the technical inefficiency is particularly interesting. The Hungarian enterprises' coefficient is positive and significantly different from zero; a lower efficiency for these enterprises is thus recorded in Hungary respect to Emilia-Romagna (Figure 1).

Figure 1 - Mean efficiency for each group of enterprises

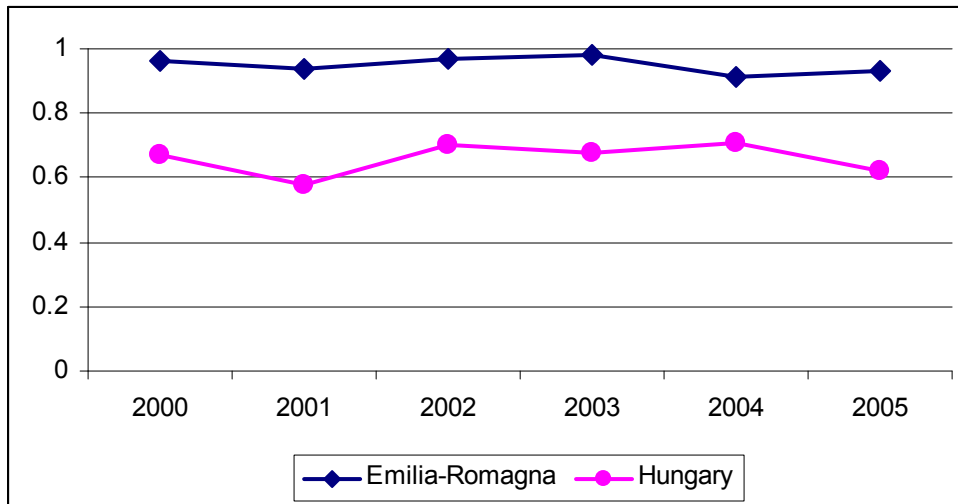


Table 5 - Stochastic Frontier Production Function and Technical Efficiency - Parameters

		Coefficient	Standard-Error	T-ratio	
Beta 0	Intercept	5.03	0.51	9.89	**
Beta 1	Trend	0.01	0.02	0.69	
Beta 2	Tangible fixed assets	0.08	0.03	2.77	**
Beta 3	Cost of employees	0.61	0.03	18.59	**
Delta 0	Intercept	0.05	0.45	0.01	
Delta 1	Hungary	0.40	0.07	6.08	*
sigma-squared		0.36	0.02	14.62	**
gamma		0,67	0,08	8,24	**

\*significant for  $t_{0,05}=1.645$

\*\*significant for  $t_{0,025}=1.960$

Sources: our processing, AMADEUS data

The coefficients of the input variables in the production function are elasticities of mean output, with respect to the different inputs for the Cobb-Douglas model. The empirical results reported in Table 5 indicate that the elasticity of frontier production respect to tangible fixed assets and cost of employees are estimated to be the positive values, 0.08 and 0.61 respectively. Thus, if the total cost of employees were to increase by one per cent, then the mean production of output is estimated to increase by 0.61 per cent.

The returns-to-scale parameter for the Cobb-Douglas production frontier is estimate by the sum of the elasticities of the two input variables to be 0.69. Hungarian's enterprises are characterized by a low level of technical efficiency, which does not seem to get better in the period considered. Enterprises in Emilia-Romagna region have high levels of efficiency, which is substantially steady throughout the period considered.

## 5. The Industrial district and agri-food districts in Emilia-Romagna

### 5.1 Industrial districts and agrifood districts

The relevance of the manufacturing industry and that of food industry in Emilia-Romagna have stimulated numerous analysis on industrial and agro-food districts. These analysis has increase after the seminal works on industrial districts done by Becattini (1987, 1989), who revisited the Marshall's analysis of industrial districts and external economies.

In Emilia-Romagna a pioneer works on Industrial districts whose carried out by Brusco (1986, 1989) and other researchers of University of Modena (2003) who, recently have organised a Conference in honour of Professor Sebastiano Brusco on 'Cluster, Industrial districts and firms: The Challenge of Globalization'.

These studies stress the new role and different pattern of the development of SMEs belonging to districts with respect to big enterprises, on the one hand, and isolated SMEs, on the other. In the last decade, the Industrial Districts (IDs) approach became an important tool with which to analyse the roles of SMEs, with regard to the remarkable economic performance of Italy over the last decades. In national, as well as international literature, Industrial Districts (IDs) are now considered one of the main factors for Italy's successful and rapid post-war industrial development.

In the last decades the IDs analysis of Italian development has concentrated on manufacturing industry as a whole and on its main sectors (e.g. mechanics, textile, furniture). The food industry, although it represents the third sector of the Italian manufacturing industry, with respect to value added, has hardly been considered in the analysis of the structural changes of the Italian economy. Little attention and analysis has been done, in particular, to the specialisation and concentration processes at the geographical level of the Italian food industry, over the last thirty years. These process have had different degree of intensity and they have influenced the structural changes of the main components of the Italian food industry (meat processing, dairy, oil, fruit and vegetables), with different roles played by SMEs and big industrial groups. These deep sector-based structural changes and the geographical agglomeration at regional and county levels has been described as a 'mosaic type of development' of the Italian food industry (Fanfani & Brasili 2006). In the same paper there are also analysed the similarity and the main differences between industrial and agri-food district, but also the growing role of the (public and private) Institution in the development of the agri-food districts.

It is not surprising that the rise of the agri-food districts analysis started manly looking at the Emilia-Romagna agri-food system. For the main districts of the regions, we have mentioned above, there are detailed studies and qualitative description of the products specialization, modality of production, production disciplinary, enterprises structure and its specialization, and more recently also about the processes of internationalization of these districts. A brief description of these studies on the main industrial districts in Emilia-Romagna, with particular reference to Parma Ham district and Fruit district of Romagna could be found in the recent work of Brasili & Fanfani (2007). In the next paragraph we will give more information about the districts of meat industry, to better understand the comparison between Emilia Romagna and Hungary.

## **5.2 Main agri-food districts and local systems in the meat industry (15.1)**

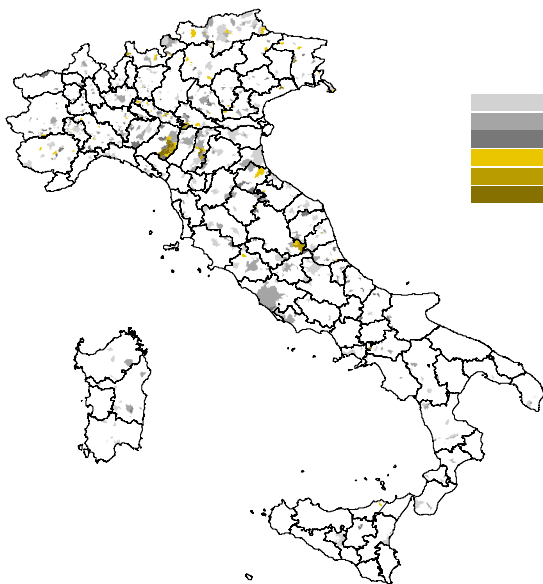
In recent years, investigations of agri-food districts have become more and more common. The Italian Institute of Statistics published new evidence concerning industrial districts with reference to the 2001 Census results (ISTAT, 2005). Only 7 out of the 156 industrial districts detected in 2001 belong to the food industry. Once again, as in the analysis of the 1991 Census, agri-food districts are largely 'under-estimated', with respect to their real and actual

importance. In the past, most attention was directed at generic attempts to provide a national mapping of agri-food districts, because of their clear underestimation and the political actions supporting quality agricultural and agri-food districts. A recent analysis concerning the identification of these districts was published by Unioncamere (2004), using a methodology similar to the one suggested by Brasili & Ricci Maccarini (2003).

This methodology uses six indices, which basically refer to the structural characteristics of the food industries and to overall enterprises population from the 2001 Census. The six indices are as follows: index of localisation of establishment (I1), index of localisation of employees (I2), index of concentration of establishment (I3); index of concentration of employees; (I4) index of specialisation of establishment (I5); index of specialisation of employee(I6).

The general Census on Industry and Services 2001 data highlight the fact that in Italy the number of local units (establishments) involved in meat industry are more than 4,450. The provinces with the largest number of local units and employees are Parma, Modena and Reggio Emilia, all located in Emilia-Romagna. The province of Parma saw a rise in the number of employees of over 13% between 1991 and 2001, while the increase in local units was lower (3.5%). Modena, and especially Cremona (in Lombardia), recorded the most pronounced reductions between one Census to the other. The indices of localisation, concentration and specialisation described above were used to identify the main local systems of the meat processing industry. A first evaluation for 2001 of these local systems using the summary index identified 10 different territorial systems of production characterized by a presence of the meat processing industry, concentrated in 65 municipalities, with over 800 local units and more than 20,700 employees.

Figure - Italian meat industry: main districts and local systems



Source: our processing on ISTAT- General Censuses of Industry and Service (2001)

The most important local system of meat industry is that which extends throughout the province of Parma, containing 438 local units and over 4,000 employees. If statistical criteria are not rigidly adhered to, the two municipalities in the province of Reggio nell'Emilia (Correggio e Reggio Emilia itself) may also be included. In the municipality of Langhirano alone, there are 155 local units involved in meat processing and transformation, employing 1,250 people. In the 79 municipalities with a summary index higher than 4, the local units characterized by meat processing industry represent over 56% of manufacturing enterprises

and 72% of employees present in those municipalities. These percentages increase to 76% and 88% respectively in the 12 municipalities where the summary index is equal to 6, denoting an almost exclusive production of meat in these areas. Hence, in the meat industry there is a progressive localisation of the meat processing sub-sector, with a reduction in the number of municipalities involved, an increase in the number of local units and employees, and a simultaneous increase in specialisation.

## 6. Conclusions

The structural changes occurred in the Hungarian economy, together with the new agricultural support established under the European Common Agricultural Policy, has changed the efficiency and competitiveness in the Hungarian meat sector. The FDI inflows and the technological progresses introduced after the EU accession haven't been able to support the competitiveness of the Hungarian agricultural production and food industry products on the world market, also because of the EU policies provide higher protection levels on food trade and requiring high productive and qualitative standards for farms and agro-food enterprises.

The agro-food sector, and inside it the meat industry, in the Emilia-Romagna region has registered a growing relevance in the regional economy. However agro-food enterprises in Emilia-Romagna have to face productivity and competitiveness problems for different reasons, mainly linked to the structure of the industry and in particular the size of the enterprises. In fact the numerous SMEs, representing the specific productive reality in the agro-food sector, often organised in *districts*, have serious problem in the internationalisation, in the recent years.

The main difference between agro-food enterprises in Hungary and in Emilia-Romagna consist in the organizational and dimensional structure, other than in the characteristics of products and in the technological equipment.

However the comparative analysis between the two realities gives some interesting results. In fact, the financial and economic characteristics of the production, processing and preserving of meat and meat products enterprises, in Hungary and in Emilia-Romagna region, shows very different realities and deep differences among these enterprises.

The analysis of the enterprises balance sheets, from 2000 to 2005, highlights a good economic and financial situation for the Hungarian enterprises. In fact, some crucial indexes show positive values as like current ratio and liquidity ratio. Moreover, also the return on shareholders funds shows good values, but with a great variability in the years considered. The value of Return on total assets confirms the positive pattern for enterprises located in Hungary, but even if there are decreasing value.

The Emilia-Romagna enterprises show a low economic performance, with poor profitability and negative coverage ratio. Instead, the value of current ratio have a good performances in the period considered.

The analysis of the technical efficiency, done utilising the stochastic production function, shows a very different level among enterprise located in Hungary and in Emilia-Romagna. In particular, Emilia-Romagna enterprises show the highest value of technical efficiency respect to that of Hungary, in all of the six years period analysed.

The analysis performed, leads us to conclude that the meat sector in Hungary could improve in the future and it could reach better results in terms of technical efficiency. In fact, the biggest Hungarian enterprises in the meat sector, have already some good economic



performances and the possibility to further developed, especially in connection with the country livestock production and the feed row materials for feeding. The further development and the relative position and efficiency of enterprises in the meat sector in Hungary, as well in Emilia-Romagna and other EU regions, will be strictly connected to the rapid structural changes in the agri-food system in the enlarged European union going on in the next few years.,

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