The cost of food safety due to animal by-product regulation in Spain: who pays for it?

A. Esturo[1], N. González[1], P. Greño[2], M. Martinez-Granado[2,3] & M. Saez de Buruaga[1]

[1]*AZTI-Tecnalia, Spain*
[2]*NAIDER, Spain*
[3]*Departamento de Fundamentos del Análisis Económico II, University of the Basque Country, Spain*

Abstract

This paper puts forward implications of the implementation of Regulation (EC) No. 1774/2002 in Spain, which regulates in an integrated manner all animal by-products that are not intended for human consumption with the maximum hygiene and environmental security. Farmers, slaughter houses, food industries, retailers, animal feed producers, fertilizer producers, transport and logistic businesses, renders, valorisation and waste management plants are activity sectors of great health, environment and economic importance and all of them play an important role in the implementation of the aforementioned regulation. This work analyses in detail the generation and management of the animal by-products in those different stages of the production chain of meat. The focus of the paper is on the transmission of the costs associated to the implementation of the regulation along the production chain. The results show an uneven distribution of the regulation costs, where the farmers face particularly high costs (which are, in general, subsidised by the Government). On the other hand, the transmission of costs to the final consumers depends on the type of animal we considered: for cattle and sheep, the lack of competitiveness in their markets also interferes in the costs transmission.

Keywords: food chain, modelling, pricing, animal by-products.

1　Introduction

The European Parliament approved Regulation 1774/2002 as a consequence of the food health crisis, to regulate in an integrated manner all animal by-products with the maximum hygiene and environmental security.

The new regulation implied new management systems and higher costs. In Spain a specific Commission was created in 2003 to establish an Integrated National Plan for the management of the animal by-products and created different working groups for each step in the food chain. The results and conclusions were gathered in the White Book for animal by-products. One of these conclusions refers to the high costs for all the participating agents to fulfil the Regulation.

The application of the Regulation 1774/2002 implied that the animal by-products not intended for human consumption generated in every stage of the chain of value of meat and other animal products (from production to retailing) should be managed by authorised agents. In each stage of the value chain these agents should collect the animal by-products, charging a price that in principle has to be transmitted along the chain to the final consumers.

In this context it is important the identification of market distortions in the costs translation, difficulties in the gathering and transport of the by-products from generation locations to transforming and treatment plants, and the need to identify the possible valorisation of these by-products.

2　Objectives

The objectives of the study are:
- To elaborate a study on the economic aspects of the management of the animal by-products not intended for human consumption in the whole food chain to facilitate more transparency in the cost repercussion and reasonable translation of costs in the Spanish chain.
- To analyse the technologies available to obtain an added value from the animal by-products

3　Materials and methods

Farmers, slaughter houses, food industries, retailers, animal feed producers, fertilizer producers, transport and logistic businesses, renders, elimination and valorisation plants, and waste management plant, among others are activity sectors of great health, environment and economic importance. The analysis carried out evaluates the process, the costs, and the distribution of the agents through: (a) the identification of by-product generation processes, and determination of derived costs to implement the Regulation 1774/2002, (b) the characterization and quantification of the generated by-products, (c) the analysis of the economic aspects of the generation and management of the animal by-products and (d) the establishment of an efficient economic model for the animal by-product management.

The methodology used to carry out the study included the following phases:

Phase I: Diagnosis of the situation in Spain: actual infrastructures inventory, identification of the relevant markets, analysis of price and quantity evolution, market concentration and analysis of animal by-product waste management costs (field work).

Phase II: Comparative analysis: comparison of the experiences in other European countries applicable in Spain.

Phase III: Theoretical economic frame of reference: the results of the previous phases allowed designing a theoretic economic frame *ad-hoc,* based in traditional supply-demand models. The main elements of the designed models are: price formation along the value chain of different animal products; transfer of the cost increments among agents; analysis of the inefficiencies and completion problems on the cost (price) transmission along the value chain of the animal products.

Phase IV: Estimation and results of the economic model: econometric estimation of price transmission along the different agents involved in the value chain of different animals (beef, sheep, pork, and chicken). This information allowed to evaluate the absence of competition in different stages of the value chain of the animals considered and therefore to throw conclusions about the final transmission of the by-product new management costs to the final consumer.

Phase V: Animal by-product valorisation: new management solutions and valorisation options are identified for the Spanish context.

4 Results

According to the data provided by the Spanish National Commission of the SANDACH (www.sandach.com.es) in 2009, 623 enterprises had the license to manipulate animal by-products of different categories according to Regulation 1774/2002 (see the SANCO/10149/2006 report) [1]. The typology of the processors is 15,5% process plants, 38,7% specific users, 17% technical plants, 13,7% intermediate plants, 4,2% storage plants, 4,4% plants of incineration or co-incineration, and 3,4% plants of compost. The process plants process most of the 2.000.000 tons generated in Spain. It is significant that no approved biogas plants are in the list. Most of the plants are located in the North of Spain (Castilla-León, Galicia, and Catalunya), where most of the bovine, ovine and pig production is located. Another striking fact is that only two plants are producing fish oils from extractive fishery wastes, but no aquaculture wastes are being used. Comparing the animal by-product plants in other European countries (Great Britain, Germany, France and Denmark), it is outstanding the number of biogas plants in Germany, whereas in Great Britain, a high number of incineration and co-incineration plants are registered. This could be due to the fact that the Bovine Spongiform Encephalopathy (BSE) started in the U.K. Spain has a very high number of specific users, processing and technical plants, when compared to other countries.
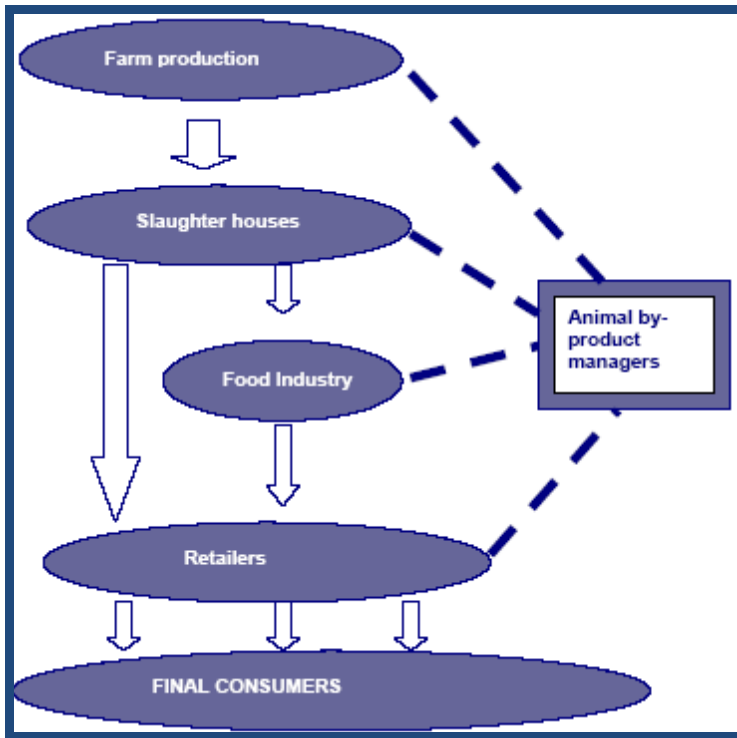
Figure 1:   Price generation in the food chain.

The agents identified in the Spanish animal by-product management chain go from farmers to consumers as shown in the figure 1.

The animal by-product generators are farmers, slaughter houses, food industries, and retailers. The processed materials are gathered and eliminated, or transformed or valorised by by-product managers. Most of the by-products are produced in the meat industry, although part is also produced in companies related to fish commercialisation and transformation industries.

The first step in the chain is the farm production. The data on production, stocks and costs are relatively simple to obtain through the Spanish Ministry of Agriculture, Food and Fisheries (now Ministry of Environment, Rural and Marine Affairs, MARM). The main production includes bovine, ovine, pig and poultry production. There is a considerable atomization of the production with an average size of the production sites of 43 heads for bovine, 231 heads for ovine, 197 for pigs and 886 for poultry. Pig production accounts for more than 40% of the total animal production considered (bovine, ovine, pig, and poultry), being Spain the second producer in Europe after Germany. (Source: own elaboration with data from the "Spanish Survey on the structure of the agricultural exploitations", National Institute of Statistics-INE, 2005.)
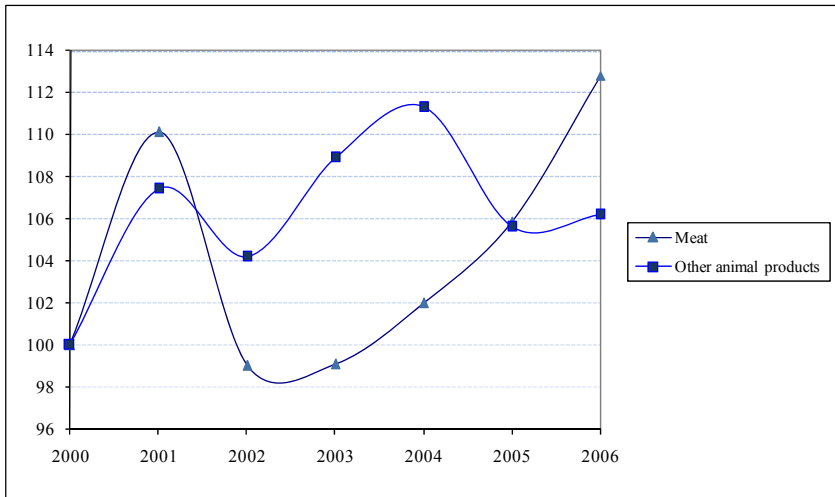
Figure 2:   Prices index for meat and animal products. Index year 2000=100 (source: MARM [3]).

Prices on the meat market are quite cyclical. Figure 2 presents the evolution of the index of prices obtained by farmers for meat (beef, sheep, chicken, pork, goat, and rabbit) and animal products (milk, eggs and wool).

The prices for animal products are much more stable than prices for meat. A high fall can be appreciated between 2001 and 2002, probably due to the decrease in the demand of bovine meat in those years. This fact is important in terms of the implications of assuming the higher costs derived from the application of the Regulation.

Slaughter houses and meat industries are the second step in the value chain. An increase in pig and poultry slaughtering is observed, being in 2005 about 58% of the slaughtered animals pigs and 23,5% poultry. As far as the structure of this step is concerned, it must be said that it is not easy to find updated data for the sector although an important atomisation of the sector is observed, with many SME (less than 11 workers). A tendency for vertical integration of the industry with the production stage is observed, mainly in the poultry and pig production (see Langreo Navarro [2] and MARM [3]). This vertical integration is important in the cost transfer: the more integrated the different steps in the value chain are the easier the cost transmission will be, as it happens with poultry and pig. The prices for meat in the slaughter houses have been increasing steadily since 2001.

Meat industry is one of the most important sub-sectors of the Spanish food industry, generating more than 16.000 million Euros in 2006. There is an important leader in this sector, and other 40 medium-big size companies with a high number of small traditional businesses. Only 23% of the companies have more than 20 employees [2].

Retailers are the last step in the chain, supplying meat to the consumers (wholesalers are not important in this sector).In 2005, 2818 tons meat and 1572
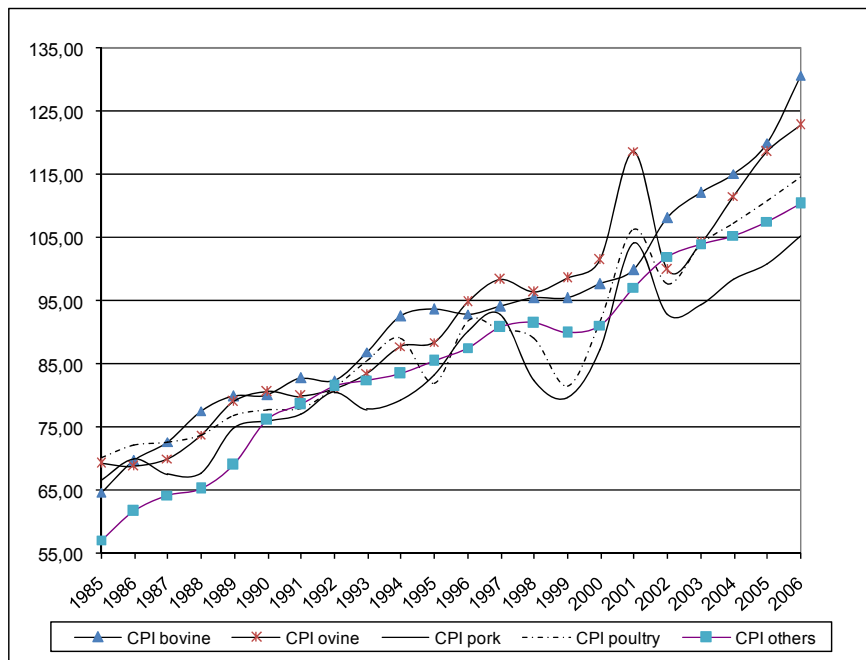
Figure 3: Consumer price index for meat consumption (source: Spanish National Statistics Institute [13]. Base year 2001=100).

tons fish products were consumed (see MERCASA [4]). Fresh meat and fish is mainly bought in traditional markets and supermarkets, and not so much in hypermarkets. The price for meat products consumption has grown steady in the last years as shown in the figure 3.

4.1 Costs of by-product management

Little information is available about the real amount of by-products generated and the costs implied by the application of the Regulation. Field work was done to collect the needed data, through personal and telephone interviews. Specific questionnaires were designed for each type of agent (farmers, slaughter houses, food industries, retailers and by-product managers) asking questions about volumes, typology of by-products, costs and inversions required to implement the Regulation (CE) 1774/2002. Finally 1012 agents were identified, where 294 were selected. 54 agents were personally interviewed and 250 agents were interviewed on the phone. This numbers include information from some firms obtained from the National Agrarian Insurance (ENESA) en the retailer association (ASEDAS).

The main results from the interviews are the following: In general, the application of the Regulation 1774/2002 has implied a cost to all agents related with the production and management of animal by-products. This was the

Table 1:   Number of interviews.

Sector	Interview number
Farmers	67
Slaughter houses	59
Food Industry	55
Retailers	60
Managers	38
Incineration	15
TOTAL	**294**

Table 2:   Estimated costs of insurance for meat as a percentage of the farm price.

	Total cost (€) per 100 kg (1)	Farm price (€) per 100kg (average) (2)	% over obtained price (3)=((1)/(2))x100
Bovine	6,4	127,5	5,1
Ovine	4,3	268,5	1,6
Swine	1,7	108,0	1,5
Poultry	0,9	89,0	1,0
(1): Total cost per 100 kg was calculated using as reference the average weights as described in the "Plan Integral de SANDACH". (2): farm price is calculated considering the slaughtered volumes of different types of animals. Data from MARM [11, 12].			

answer of 53% of the farm producers, 80% of the slaughter houses, 52% of the retailers, 45% of the food industry producers, 66% of the by-product processors and 78% of the (co-)incineration plants and dumps. Often by-products of category 1 and 2 are indistinctly treated.

The increase in the costs has been double: on the one side the investments in infrastructures and equipments to treat the by-products have been high, specially for some agents (slaughter houses, incineration and co-incineration plants, dumps, and by-product processors); on the other side, the marginal costs of processing in each stage the by-products has also increase. However this cost differs for the different agents implied.

For farmers, the cost has been mainly due to the management of the category 1 of by-products, which implies the collection and destruction of dead animals in the exploitation. This operation is usually paid by an agrarian insurance, heavily subsidize by the local or central governments. The costs are presented in table 2. As it can be seen the costs of retiring dead animals imply a 5.1% of the price received by the bovine farmers, and between 1 and 1,6% for the rest of the farmers.

However, it has to be mentioned that bovine farmers have an extra cost that slaughter houses apply when slaughtering the animals to cover the destruction of the by-products, which is done according to the legislation Orden APA/67/2002,

Table 3:   Cost of management of by-products in the different sectors (€/kg of by-product; it does not include the retrieval of dead animals from exploitations).

		Cat. 1	Cat. 2	Cat. 3
Farms of bovine	(to slaughter houses)	0,48-0,52		
Slaughter houses		0,32	0,17	0,12
Industry	Average	0,22	0,06	0,06
	Meat	0,22	0,06	0,09
	Fish		0,12	0,02
Meat retailers	Average			0,28
	Central Markets			0,14
	Hypermarkets			0,15
	Supermarkets			0,25
	Traditional shops			0,23

which establishes a control systems for the food by-products (see table 3). The idea of the regulation was to give transparency in the by-product generation and the related costs. However, it seems that slaughter houses apply the costs to the farmers, instead of to the retailers. Not only that, the price charged to the farmers do not correspond to the one charged by the by-product managers, therefore they use this activity as another lucrative aspect and they have certain market power (they charge more than the marginal cost they pay the by-product managers). Farmers pay twice the cost of by-product elimination (through the agrarian insurance and when selling the animals). In a competitive market the firs cost could be passed on to the second chain, but the second cost no.

For slaughter houses, table 3 shows the average cost for the disposal of the different categories of by products. It is important to mention the high dispersion of costs across regions, being more expensive to manage the by-products in the North of Spain.

With respect to the food industry, the meat sector is the one with higher costs. In some cases, the slaughters take care of the costs of by-product processing. It has to be mentioned that in the case of fish transformers there is a special difficulty in the identification for the by-product manager.

Small retailers (traditional shops) declare in general not to incur in any costs (64%). Central markets and hypermarkets obtain better prices than smaller shops. They tend to pay higher prices than the food industry or the slaughter houses.

Finally, it is important to mention that although the by-products processing plants have also incur in important costs to adapt their installations, they have also received higher subsidies than in other sectors. Additionally there is evidence that they have some market power to set prices, as shown by the geographical dispersion of prices charged and the comparison with the cost of transformation or disposal of the by-products.

4.2 Economic frame and cost transmission

Once established the increase in costs in each stage of the value chain of meat and fish, here we concentrate in the transmission of costs along the meat value chain, the one that concentrates the higher costs. If the markets work in perfect competition, the increase in the marginal cost of production of meat would imply an increase in the sale price in each stage equivalent. Therefore the higher costs implied by the Regulation will be to some extend passed to the final consumers as intended and to some extent assumed by the producers in each stage of the value chain, depending on the supply and demand curvatures. See Unnevehr et al. [5] or Radwan et al. [6] for evidence in these curvatures.

However, if the market is not perfectly competitive, some of the firms participating in some of the stages of the value chain can avoid their portion of the costs by imposing prices to the following or previous stages. They would use their market power (as sellers or buyers) to avoid these costs. In this section we analyse whether this is the case. For doing so, we estimate an econometric model in which the prices charged by retailers (and paid for the consumers) are a function of the prices charged by the farm producers (there is no information about the prices charged by slaughter houses). We follow Tomek and Robinson [7] and Jumah [8]. The equation estimated is:

$$P_{ft} = c^* + a^* P_{gt} + \varepsilon_t$$

where P_f is the price paid charged by the retailer and P_g is the price charged by the farm producer. The test of market power is done through the test of the null hypothesis that $a^* = 1$. The estimation follows the Engle and Granger [9] two stage procedure that accounts for non stationary of the series and uses a Vector Error Correction (VEC) econometric specification.

The main results of the estimation are presented in table 4. No market power is apparent in the pork and chicken markets, but its presence cannot be rejected in the case of the beef and sheep markets. The results are compatible with the existence of market power from the slaughter houses already indicated in the

Table 4:　Results from the econometric analysis: long run relationship.

	Beef		Pork		Sheep		Chicken	
	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.	Coeff.	t-stat.
P_t^g	3.87*	6.62	0.77*	5.38	7.77*	-6.14	0.90*	6.55
Constant	2.10*	1.82	0.30*	17.44	20.46		1.56*	11.37
Draft	YES		YES		NO		NO	
Time Dummy	YES		YES		YES		NO	
Seasonal Dummies	NO		YES		YES		NO	
* Significant at 5%								

previous section with respect to the bovine sector, although some market power from retailing might be also present, especially if the market concentration of the sector in recent years is taken into account.

4.3 By-product management and valorisation

By-products are traditionally transformed to eliminate the water and extract the fats. The products of this transformation are meals or animal proteins and fats used as feed, or in chemical industries for soap production.

There are other transforming alternatives already used in Europe, which can be classified according to their energetic component in three different groups: low, medium and high energy (see Woodgate [10]).

4.3.1 Low energy
The management alternatives for animal by-products range from burials, dumps, compost windrow production, anaerobic digestion (biogas production) and liquefaction.

4.3.2 Medium energy
In this category process for pet food production, alkaline hydrolysis, high pressure hydrolysis, biogas production by pressure hydrolysis, biodiesel production and Brookes gasification process can be found.

4.3.3 High energy
The incineration is an oxidation at high temperature to transform the product into gases and ashes. There are different types of incinerations: Bubbling Fluidised Bed, Circulating Fluidised Bed, Rotary incinerator oven, and continuous incineration.

After analysing the environmental effects of each of the alternatives, as well as the induced effect, the applicability and the economical aspects, it is difficult to compare the different technologies, and therefore it is not simple to make recommendations. Considering environmental criteria (air emissions, effluents to waters, effluents to soil, energetic resources and CO_2 balance) and the sustainability criteria (waste hierarchy, regulations, capacity, society and environmental troubles) the best options are: (a) the transformation into meals and fats for animal feed, (b) transformation into meals as fertilizers, (c) transformation into meals to be used as fuel in the plant and (d) incineration with energetic recovery. The worst option is the disposal in a controlled dump (with or without energetic recovery).

5 Conclusion

Application of Regulation 1774/2002 has incremented the costs in the Spanish meat production chain and to a lesser extent fish production chain. The cost increase in most of the cases implies acquisition of infrastructures and equipments, and an increase of the marginal costs per production unit for the

animal waste generators. It is observed that animal by-products of category 1 and 2 are managed with no distinction. This is an identified aspect for improvement. According to the observed data it seems that by-product renders and slaughter houses have certain market power at least in the bovine and ovine markets. Renders generate higher prices than expected, and slaughters pay less than expected in a competitive market. Nevertheless the econometric analysis (price of meat for farmers and price of meat for consumers), partially confirms the hypothesis: while the pig and poultry markets are competitive, the bovine and ovine market, have difficulties to transmit the prices and cost of application of the Regulation.

Acknowledgements

References

[1]   SANCO/10149/2006. "Technical specifications in relation to the master list of lists and the list of approved plants handling animal by-products", European Commission.

[2]   Langreo Navarro, Alicia. "La industria cárnica en España". Distribución y Consumo, 5, May-June 2006.

[3]   MARM (Ministry of Environment and Rural and Marine Affairs), "Sector cárnico español", 2001.

[4]   MERCASA, "Alimentación en España 2007: producción, industria, distribución y consumo", 2007.

[5]   Unnevehr, L.J., M.I. Gómez, and P. Garcia. "The Incidence of Producer Welfare Losses from Food Safety Regulation in the Meat Industry", Review of Agricultural Economics, 20 (1), pp.186-201, 1998.

[6]   Radwan, A., Gil, JM., Ben Kaabia, M., Serra, T., "Modelling the impact of food safety information on meat demand in Spain", 107th European Association of Agricultural Economists Seminar, Sevilla, 2008.

[7]   Tomek, W.G., y Robinson, K.L., "Agricultural Product prices", Cornell University Press, Ithaca, 4rd edition, 2003.

[8]   Jumah, A., "The long run, market power and retail pricing", Empirical Economics, 29, pp. 605-620, 2004.

[9]   Engle, R.F., y Granger, C. W. J., "Cointegration and error correction: representation, estimation and testing", Econometrica, 51, pp. 277-301, 1987.

[10] Woodgate S., "What would a world without rendering look like?" in Essential rendering: all about the animal by-products industry, 2007.

[11] MARM (Ministry of Environment and Rural and Marine Affairs), "Survey about farm prices for agriculture and stockbreeding", 2005.
[12] MARM (Ministry of Environment and Rural and Marine Affairs), "Survey of cattle slaughter", 2005.
[13] Spanish National Statitistic Institute (INE), www.ine.es.