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# CROSS COMPLIANCE AND COMPETITIVENESS OF THE EUROPEAN BEEF AND PIG SECTOR

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## **Abstract**

Beef and pig production are important sectors affected by the cross-compliance policy. Full compliance with SMRs and GAECs generates costs and benefits which may have an impact on the competitiveness of these sectors on the world market. Compliance with the Nitrate Directive, animal identification and registration requirements and animal welfare standards can give rise to non-negligible cost of production increases at individual farm level and at sector level. Additional costs can be relevant either due to a low degree of compliance or by significant adjustments costs at farm level. Full compliance generates a level playing field between Member States of the EU, as some countries have to face higher additional costs than others, which are attributed to differences in degree of compliance.

This paper first presents evidence of additional costs at individual farm level due to full compliance. Then for beef and pork a methodology has been developed in order to calculate sector cost impacts following an upscaling procedure for each of the analysed directives. Simulations with the GTAP model have enabled an assessment of the trade effect of compliance with standards and the impact on the external competitiveness of the EU beef and pork production.

In some policy fields covered by cross-compliance important trade partners such as Canada, USA and New Zealand have implemented policies similar to the EU. In these three countries comparable standards to those in the EU were identified and the level and cost of compliance have been assessed. The pig sector will be affected most by a unilateral compliance with standards in the EU, in particular as the Nitrate Directive is concerned. Within the EU pig production costs will rise by 0.545 %. Imports may increase by 4% and exports may fall by 3%. However full application of the Clean Water Act in the US, which contains similar obligations to the Nitrate Directive, generates a significant sector cost increase (1,08%) which may counterbalance the loss of competitiveness of EU pork production towards the US.

Compliance with the mandatory animal welfare standards has only minor cost implications and has negligible effects on external competitiveness of the EU both because of a high degree of compliance and relatively low adjustment costs at farm level.

Finally, in many EU member states the degree of compliance of beef farms with the animal registration and identification directives is below 100%. Additional costs for full compliance within the EU have been estimated at 0.455%, which may cause an increase of beef imports of 2.21% and a decline of exports of -2.12%. This loss in competitiveness of the EU will further favour the position of Brazil on the world beef market. At the other hand significant benefits are obtained in food security of EU beef.

**Keywords:** Cross compliance, beef sector, pork sector

**JEL Code:** Q10, Q18

## Introduction <sup>1</sup>

Cross compliance, introduced with the 2003 CAP reform, links direct payments to farmers to their respect of regulations in the field of environmental protection, public, animal and plant health and animal welfare. It is best understood to be an additional enforcement mechanism, which uses financial leverage to encourage compliance with standards. The Statutory Management Requirements (SMRs) of 19 Directives and Regulations mentioned in regulation 1782/2003 are all pre-existing items of EU legislation, although there have been compliance issues in the past. Compliance with Good agricultural and environmental condition (GAEC) standards, whilst presenting a new framework to impose standards, have largely been utilised by Member States as a tool to enforce and enhance understanding of other pre-existing mandatory requirements.

In this paper we will focus on the additional costs cross compliance may generate in the beef and pig sector. For both products the most relevant standards were identified and an assessment was made of the level of compliance and the cost of compliance. The subsequent analysis then focused, first, on the additional cost of compliance if compliance levels were to become universal, and second, on the impact this would have on trade flows of the EU with the US and other competitors on the world market.

**Table 1 - Standards Selected for EU and non-EU Countries**

<b>Chapter</b>	<b>Product</b>	<b>Evaluated standards</b>
1	Beef	Nitrates (EU) Identification and Registration (EU) Clean Water Act (USA)
2	Pigs	Nitrates (EU) Animal Welfare (EU) Clean Water (USA)

In parallel, environmental standards applied to farmers in the US and based on the Clear water act are taken into account, comparable standards to those in the EU were identified, and an attempt has been made to assess the level of compliance and the cost of compliance.

From the review of all SMRs and GAEC standards it appears that in particular the Nitrates Directive, food safety requirements and animal welfare standards might give rise to non-negligible cost of production increases, at least at individual farm level and potentially

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also at sector level. Although the potential cost impact of the rules concerning the identification and registration of farmed livestock (i.e. using eartags, passports etc) is low, the analysis shows that farmers face significant problems with compliance.

### **Cross compliance in the beef sector**

At first we will provide a comparative overview of the competitive assessment of CC requirements in beef production. We will focus here on the EU Member States and the US as one of the main key actors in world beef market.

Not all regulations and directives of Annex III will generate significant cost increases at farm level as many will exert only marginal constraints on beef farming. Here we will concentrate our attention on the Nitrate Directive and Identification and Registration of bovines. Hence, focus in this section will be on these directives and on similar legislation in vigour in the USA. A comparison will therefore be made between the regulatory tools of the Clear Water Act of the US, which aims to improve and protect water quality and the mandatory standards established by the Nitrate directive in EU. An effort will be made to compare the impact on competitiveness of EU and US beef sector in case of full compliance with the respective environmental regulations.

### ***Evaluated standards and cost implications***

The main requirements established by the Nitrate directive is the respect of the limit of 170 N kg/ha<sup>2</sup> which may generate extra-costs for a correct manure disposal. In Nitrate Vulnerable Zones (NVZ) farms the exceeding maximum limit have to find extra land to spread excess manure, either by buying or renting land or paying a license to spread manure on land of nearby farmers. Moreover, they are obliged to invest in manure storage facilities due to the prohibition to spread manure in winter time.

The evaluation of the impact deriving from a full application of Nitrate directive requires a preliminary analysis of the data of the structure of the prevailing beef farming systems in the EU, in order to detect the share of farms and the share of beef cattle which may be affected by the Nitrate Directive.

### ***Affected beef production***

Out of the 491,000 farms engaged in beef production about 50% are cow calf farms, over one quarter (27%) are specialised beef finishing farms and 20% have a coupled production of dairy and beef (Sarzeaud *et al.*, 2007).

Striking to note is that 44% of beef production originates on farms where dairy is the main livestock activity, another 14% is produced in fattening farms and 35% in cow calf farms. Extensive production systems tend to predominate in the EU as on 47% of the cattle

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<sup>2</sup> Or 250 kg N/ha on grassland in some Member States.

farms the stocking rate does not exceed 1.4 LU per ha. Typically extensive are the cow calf farms, whereas the pure fattening farms often exceed a stocking rate of 1.8 LU per ha (see Table 2).

**Table 2 - Breakdown of cattle farms in beef farming systems in the EU**

Production	Cow calf (CC)			Fattening (F.H)			Dairy		Small farms	Total
	CC+ Sheep	CC+ fatt	Pure CC	Fatt.+ sheep	Pure fatt	small fatt.	Dairy +Beef	Pure dairy		
N. farms	49,889	65,100	171,388	9,202	12,656	58,763	123,788	338,725	91,404	920,916
Acreage (ha)	151.9	73.3	69.7	87.9	94.0	45.9	81.5	56.9	19.8	63
Livestock unit	52.5	61.4	47.4	39.5	127.2	31.6	93.6	66.7	3.8	58.1
% BFS farms	5%	7%	19%	1%	1%	6%	14%	37%	10%	100%
% Beef Production (in value)	6%	11%	24%	1%	6%	7%	20%	24%	1%	100%
<1.4 LU/ha	32,428	32,550	123,399	2,669	1,898	32,907	38,374	115,167	54,842	432,831
1.4 – 1.8 LU/ha	11,474	17,577	25,708	4,417	3,544	11,165	39,612	98,230	11,883	230,229
>1.8 LU/ha	5,987	14,973	22,280	2,116	7,214	14,691	42,088	125,328	24,679	257,856
<1.4 LU/ha	65%	50%	72%	29%	15%	56%	31%	34%	60%	47%
1.4 – 1.8 LU/ha	23%	27%	15%	48%	28%	19%	32%	29%	13%	25%
>1.8 LU/ha	12%	23%	13%	23%	57%	25%	34%	37%	27%	28%

Source: Sarzeaud *et al.*, 2007

From the sector structure description it turns out clear that not all beef production systems will be affected by the Nitrate Directive. The beef farms having a stocking rate of less than 1.8 LU per ha will have no problems to comply with this directive. In terms of farm numbers this means that 72% of the beef farmers in the EU are not affected. From the remaining 28% part of the beef finishing farms and a small minority of cow calf farms will eventually face costs of compliance.

**Table 3 - Comparison of 1.8 LU per hectare with maximum stocking rate allowed in Nitrate Vulnerable Zones**

	Heads per hectare	N in manure	Max. stocking rate in NVZ	% underscoring 1.8 LU limit
Beef bullocks 1 – 2 year	2.6	58	2.93	13%
Suckler cows	1.8	68.5	2.48	38%

Source: Elaborated by CRPA on ERM/AB-DLO, 1999.

In order to assess the share of farms affected, the upper limit of 1.8 LU per ha has been compared to the maximum stocking rate allowed within the Nitrate Vulnerable Zones. For beef finishing farms the 1.8 LU per hectare underscores the maximum stocking rate in NVZ by 13% and in cow calf farms by 38%.

If we presume a proportional distribution of the intensive beef farms above and below the maximum allowed stocking rate we can conclude that 87% of the *intensive* beef finishing farms and 62% of the *intensive* cow calf farms will have to face costs <sup>3</sup>.

**Table 4 - Share of beef farms in the EU affected by the Nitrate Directive**

	Cow calve farms		Beef fattening farms		EU
	N. of farms	%	N. of farms	% affected	N. of farms
Farms >1.8 LU/ha	43,240	100.0	24,021	100.0	67,261
Farms exceeding 170 N kg/Ha	29,403	68.0	20,898	87.0	50,301
Exceeding farms in NVZ	11.467	39.1	13.375	64.0	24,842
	<b>Cow calve farms</b>		<b>Beef fattening farms</b>		<b>EU</b>
Total EU farms	286,377		80,621		366,998
Total farms exceeding 170 N kg/Ha in NVZ	11.467		13.375		24,842
% farms exceeding 170 N kg/Ha in NVZ	<b>4.0</b>		<b>16.5</b>		<b>6.7</b>

Source: Elaborated by CRPA on Sarzeaud et al 2007.

However these percentages are still overestimated, because here we presume that the whole territory of the EU is declared as a Nitrate Vulnerable Zone. When with the REGIO databank in each Member State a comparison is made of the geographical distribution of suckler cows and fattening calves with the maps designing the Nitrate Vulnerable Zones it turns out that in the EU 15 39% of suckler cows and 64% of fattening calves are raised and finished in NVZs.

Table 4 translates these figures in number of farms. The outcome of this analysis reveals that 24,842 beef farms (6.7% of the total number of cattle farms) in the EU-15 will face a cost increase due to the application of the Nitrate Directive. In terms of affected production this would mean 3% of beef produced in cow calf farms and 4.2% of beef in finishing farms.

<sup>3</sup> Intensive cattle farms are those exceeding 1.8 LU/ha.

*Impact of improved compliance with Nitrate Directive on beef farm costs*

The calculation of the cost of compliance with the Nitrate Directive was carried out considering a typical beef finishing farm producing young bulls. The related technical and economic data have been drawn from the sample of beef farms built up by CRPA for the yearly monitoring of beef farms production costs in Italy (Ismea/CRPA, 2006).

The average herd size equals 1,200 young bulls, the yearly slurry production is equal to 15,756 m<sup>3</sup> corresponding to a nitrogen content of 50,904 kg. Net beef production is 538 tons per year and the starting and final weight of the young bulls are 370 and 640 kg liveweight respectively. The farm disposes of 151 hectares of agricultural land available for cattle slurry spreading.

Supposing that first the area is recognised as an ordinary zone, the only cost deriving from the current situation is given by storage and slurry distribution on own farmland. Now the area where the farm is located is declared as a NVZ and therefore it will be necessary to add farm land (75 ha) in order to respect the maximum allowed limit of 170 kg N per hectare. This entails an extra-cost for acquiring the right of spreading on lands owned by others and to transport the excess manure to these farmlands that are supposed to be situated 15 kilometres from the beef farm. Furthermore, the size of basins for storing slurry must be increased up to the minimum capacity required, corresponding to 180 storage days.

**Table 5 - Slurry storage and distribution costs in ordinary Zone and in NVZ (increase of land availability and slurry treatment)**

Costs		Ordinary zone	Nitrate vulnerable Zone	
			Spreading at 15 km	Effluent treatment and spreading
Storage cost	€/kg	0.035	0.051	
Effluents treatments costs	€/kg			0.129
Slurry spreading cost	€/kg	0.023	0.162	0.060
Cost of slurry management	€/kg	0.058	0.213	0.215

Source: CRPA.

Table 5 above reports the comparison between the slurry management cost in the two different situations (in ordinary zone vs. vulnerable zone) and under the hypothesis that compliance with the Nitrate Directive is fulfilled through the increase of land availability. The total average cost is expressed per kg of live weight.

The option to spread manure on neighbouring land may not be feasible when in the surrounding area the land supply is scarce and livestock farming density is high. In this case



manure treatment systems would be needed. The treatment equipment is designed for reducing Nitrogen content in animal slurry (centrifuge for the solid fraction separation and aerator for the liquid fraction), allowing to reduce the need for land outside the farms from 75 to 21 hectares. Contemporarily the sale of compost produced through the composting of the solid fraction (separated from the liquid one) represents an extra revenue that in part compensates the operating costs of the treatment process.

This latter option does not involve significant differences with respect to the first (acquire spreading rights from other farmers). The average costs entailed by the two solutions can be compared to the total production costs as calculated by CRPA (Ismea/CRPA, 2006) based on a samples of typical Italian beef farms. Considering that the total cost in 2006 was equal to 2.57 €/kg l.w. (including the purchasing cost of weaners), the percentage cost increase entailed by both alternative options can be estimated in 5.8%.

#### *Impact of improved compliance with Nitrates Directive on the EU beef sector*

According to the analysis of the structure and the regional distribution of cow calf and beef fattening farms, 3.0% of beef produced in cow calf farms and 4.2% of beef cattle in the finishing farms would be affected by Nitrate Directive and subjected to an increase of production costs. If we assume that 50% of the beef farms is already complying with the Nitrate Directive 1.49% of beef produced in cow calf farms and 2.10 % of beef produced in beef fattening farms will effectively face a cost increase in order to attain a 100% compliance at EU level (Table 6).

**Table 6 - Estimate of beef production affected by the Nitrates Directive**

	<b>Cow calf</b>	<b>Beef fattening</b>	<b>Total</b>
Total farms exceeding 170 N kg/Ha in NVZ	11.467	13.375	24.842
% of beef value*	74,5	25,5	100
% of farms affected by nitrate directive	4,0	16,5	7,2
% of beef affected	3,0	4,2	3,3
degree of compliance	50,0	50,0	50
% of affected beef	1,49	2,10	1.7

\* excluding beef value produced in dairy farms

Source: CRPA.

The cost increase for this farms has been estimated in 0.155€ per kg beef. In order to estimate the impact on EU beef sector, the production cost analysis of the Agribenchmark coordinated by the Federal Institute for Agriculture (FAL) has been used. A weighted average of Agribenchmark beef farms network generates an average production cost of beef of €

2.67/kg in the EU. The increase for those farms located in NVZ which exceed the limit of 170 kg N per hectare would then be equal to 5.8%. The table above shows that it interests only 1.7% of EU beef production. The sector cost increase will then be limited to 0.095%.

*Impact of regulations against water pollution (Clean Water Act) on the cattle feedlot farming in US*

In the U.S the Clean Water Act (CWA) is the primary law for the protection of the surface water quality. Among the other mandatory standards imposed upon US farmers, the regulatory tools employed by the CWA can be compared to the requirements established by Nitrate Directive in EU. Initially, the primary focus of CWA was on point sources of pollution from industry and wastewater treatment plants, but in recent years it has been expanded to include farming activities. Until December 15<sup>th</sup>, 2002 the federal government issued specific rules governing Concentrated Animal Feeding Operations (CAFOs), defined as animal feeding operations with greater than 1,000 animal units (700 dairy cows, 1,000 beef cows, 2,500 hogs, or 100,000 chickens).

Under the recent rule, all farms designated as CAFOs are required to obtain a permit under the National Pollution Discharge Elimination System (NPDES) that entails the implementation of a comprehensive nutrient management plan (CNMP). The CNMP must be specific for the operation and detail the proper management of all animal manure produced. It must address the assimilative capacity of the farm's land for the manure and other nutrients applied to the land. The implementation of CNMPs often result in operations seeking additional land on which to spread manure and/or the use of alternative nutrient control strategies for manure.

Feedlot beef farming has been considered in order to estimate the costs of compliance with US regulations concerning water quality. Cost of compliance is related to the implementation of the CNMP that is required for all livestock farms recognized as CAFO. In case of beef farms, CAFO are feeding operations with more than 1,000 beef cows.

The United States Department of Agriculture (USDA) has estimated at \$14 per AU (Animal Unit) the average costs for developing and implementing a successful CNMP in specialised feedlots farms, considering an average size of 1,300 heads per operation. These figures are the basis for calculating the average costs of CNMP implementation in a typical cattle feedlot in Texas, that is the leading beef producing state in the U.S accounting for 27% of total beef production (see Table 7). For this analysis, the CNMP compliance costs per AU were constructed for the average size of Texas feedlots with more than 1,000 heads, equal to 22,462 head per farm.

**Table 7 - Estimated expenses and CWA compliance costs for Texas feedlot, 2007**

<b>Expenses:</b>	<b>\$ per head</b>	<b>%</b>
750 lb. feeder steer	814.73	72.0
Total feed, handling, and management charge	257.52	22.8
Interest on feeder and 1/2 feed	44.63	3.9
Death loss (1% of purchase)	8.15	0.7
<b>Total Expenses</b>	<b>1,125.03</b>	<b>99.5</b>
CAFO CNMP costs	6.21	0.5
<b>TOTAL COSTS</b>	<b>1,131.24</b>	<b>100.0</b>

Source: Winsten (2007).

Because the average CNMP costs decrease as farm size increases, the USDA estimated costs per AU (14\$) for all U.S. feedlots would overestimate the total costs for the larger feedlots. To account for the lower CNMP costs associated with larger feedlots, an adjustment factor was calculated. When applied to the \$14 per AU cost for a typical US fattened cattle operation, the resulting CNMP compliance cost is estimated to be \$7.53 per AU, or \$6.21 per head. Based on the average feeder cattle production estimates on Texas feedlot (50,000 heads, assumed 450 pound increase in finishing size), the \$6.21 CNMP compliance costs per head result in an estimated 0.55% increase in total feedlot production costs, as compared to a 5.8% cost increase in a large feedlot in Italy which has to comply with the Nitrate Directive.

***Identification and Registration of Animals: evaluated standards and cost implications***

Essentially a beef farm in order to comply with the Reg 1760/2000 will have to update registers and eartags continuously otherwise he will either be fined (ordinary compliance) and/or his single farm payment will be cut (cross compliance). The costs generated by the mandatory part of these directives have essentially an administrative nature. They are related to the time necessary to update the registers and to the purchase of eartags for new born calves, for imported calves and for eartags lost during the lifetime.

***Impact of compliance with Identification and Registration of animal requirements***

The costs per head, including costs for the eartags accidentally lost, range from a minimum of 1.80€ per head in France up to €5.00 per head in the Netherlands (Research Report D13, 2007). In order to estimate the impact on the EU beef sector the production cost analysis of the Agribenchmark coordinated by the Federal Institute for Agriculture (FAL) has been used. Considering the total production costs per farm it is possible to calculate the percentage cost increase per kg beef to be attributed I&R of beef cattle. The seven countries listed below in Table 8 represent almost 90% of beef production of the EU-15.

Presuming an almost 100% compliance we obtain an average weighted cost increase of 0.455% for the EU-15. The variation in the cost impact of I&R is either due to the cost per head of registration or to the herd size. In countries with large herd size some economies of scale can be exploited, whereas small herds, like for example in Ireland, are facing a more significant effects.

**Table 8 - Production costs increase per kg beef related to the I&R of beef cattle**

	FR	DE	IT	NL	UK	ES	IR
Cost I&R per head	1.80	2.92	2.20	5.00	4.20	2.20	4.20
Production cost per kg	6.17	5.59	4.83	6.40	8.54	5.21	6.80
Production cost €/kg c.w.	4.47	4.05	3.50	4.64	6.19	3.78	4.93
Production cost €/kg l.w.	2.63	2.27	2.17	2.60	3.40	2.07	2.66
n. cattle sold per year	75	394	1.825	50	48	2.901	80
Kg/l.w produced/head	248	263	177	143	143	188	96
Carcass yield	59%	56%	62%	56%	55%	55%	54%
Beef production farm	18,500	103,592	323,362	7,150	6,887	545,373	7,690
% loss	5%	5%	5%	5%	5%	5%	5%
Cost eartags	134.1	1149.02	4013.90	250.00	201.60	6381.47	336.00
Cost of I&R per kg beef	0.007	0.011	0.012	0.035	0.029	0.012	0.044
<b>% cost of I&amp;R</b>	<b>0.16%</b>	<b>0.27%</b>	<b>0.35%</b>	<b>0.75%</b>	<b>0.47%</b>	<b>0.31%</b>	<b>0.89%</b>
Beef cattle (males more than 1 year) '000	1,397	1,151	845	93	1,583	340	1,604

Source: CRPA calculations on Agribenchmark.

### **Standards and external competitiveness**

The impacts of compliance with standards that have been analysed above are simulated with the GTAP model to assess the competitiveness of EU beef sector on the world market. Three scenarios, all targeting at full compliance, are summarised in table 9

The analysis on the impact of Nitrate Directive (see scenario 1) has pointed out a quite limited impact on EU beef farms (an increase of costs 0.095%), primarily due to the low share of farms that would be affected. The effects on EU beef export could be a 0.7% decrease in quantity, while import would raise by 0.5%. The shares on global export and import are expected to change respectively at the same extent. Considering the indirect effects on beef traded by the other exporting countries, the main advantage would be taken by Brazil with an increase of 0.3%. For Australia; the US and Canada no significant changes would occur. The EU-15 is facing a cost increase of 0.455% per kg beef for maintaining a system of identification and registration of beef cattle. Between EU Member States it varies from 0.16% in France up to 0.89% in Ireland.

As it is shown by Scenario 2, costs increase due to I&R regulations entails an increase of EU trade deficit in quantity: a 2.2% growth of beef imports and a decline of the same

extent in exports. EU share on world export market would decline by 2.2%, while a 2% increase of the share on global import is foreseen. Negative impact on EU beef competitiveness entails positive changes in the market share by some of the main beef exporting competitors. Going further into details it can be concluded that in particular Brazil would gain 1.1% expanding its exports by 1.2%. The performances of the other competitors on the world market would be affected to a smaller extent by the EU decline. The share gains of Canada, the US and Australia are expected to be negligible. The increase of beef traded by these countries should be limited to less than 0,2%, due to the fact they compete on different markets than those where EU is engaged. Benefits would be higher for the export from the rest of the world, that on the whole should raise by 1.2%.

**Table 9 - Percentage changes in trade due to full compliance to various standards**

	Scenario	EU Import	EU Export	exports of which to...				Total world trade
				Japan	USA	Rest of OECD	Rest of World	
1	Nitrate EU: 100%	0.53	-0.67	-0.75	-0.77	-0.71	-0.65	0.01
2	I&R EU: 100%	2.21	-2.12	-2.00	-2.01	-1.86	-2.15	0.12
3	Nitrate EU: 100% and I&R EU: 100%	2.72	-2.73	-2.67	-2.73	-2.54	-2.74	0.13

Combining the effects of both standards in Scenario 3 (Nitrate Directive and I&R), an overall decrease of 3.7% would affect EU export. The loss in quantity on the Japanese market would be equal to 2.64% while export towards other OECD would decrease by 2.54%. On the whole Brazil would gain 1.4% of his global market share, while in terms of share gains a the advantages for other main world competitors, such as Australia, Canada and USA would be negligible.

### **Conclusions**

Within the EU beef is produced in a wide range of farming systems, ranging for the extensive cow calf farms in Ireland, the UK and the centre of France down to the very intensive beef fattening systems located in Italy and Spain. This low percentage of farms affected by the Nitrate Directive explains the limited sector cost increase. Evidently this relatively low cost impact does not have significant consequences for the competitive position of the EU beef production on the world market.

More incisive for the beef farms are the regulations concerning the identification and registration of beef cattle. According to the estimates carried out these important measures generate a cost increase for the beef farms of 0.454% in the EU. Naturally this stronger rise in production costs affects EU trade more considerably. Beef imports will grow by 2.2% and

exports will decline with the same percentage. Again Brazil can exploit most this decline of EU competitiveness increasing its exports to the EU with 2.18% and its global exports with 1,1%. The other competitors on the world market would benefit much less.

## **Cross compliance and the pig sector**

### ***Introduction***

This second section is dedicated to the impact of those Directives and Regulations that, being applicable to pigs farms, may affect the competitiveness of the EU pig sector with respect to its main competitors in world market. As a preliminary remark, it is important to underline that only some pig farmers are involved in the CC policy, because the large majority is not eligible for a single farm payment. This is the case of those farms which did not mature any direct payment in the past due to the fact that within the poultry and pigmeat Common Market Organisation (CMO), no direct/coupled support to income were foreseen. Therefore, for this group of farmers no penalties could be imposed in terms of reduction of a single farm payment. In case of no compliance they are only subjected to fines provided by the national application of the EU directives.

However, for the assessment of the costs arising from SMRs we will take account of all farmers, independently of their degree of involvement in CC, supposing that Cross-Compliance has made them more aware of the obligatory compliance with SMRs and, on the other side, that the member States are more resolute in demanding their full application. For these reasons the crucial determinants for the analysis of the impact on sector competitiveness, is the estimate of the degree of non-compliance which determines the expected costs increase that would occurred in a situation of full compliance.

### ***Nitrates Directives: evaluated standards and cost implications***

To assess how many pigs farms potentially are affected by the Nitrate Directive the following stepwise procedure has been followed:

1. calculate for the main producing countries the number of farms which have a stocking rate per hectare exceeding the limit of 170 kg N per hectare;
2. estimate the number of pigs raised within Nitrate Vulnerable Zones.

Then, a literature inventory has enabled to establish the cost increase related to compliance with the Nitrates Directive for a typical pig farm in each of the selected countries. Together with the estimated degree of compliance it has been possible to calculate the percentage cost increase at sector level.

### ***Affected pig production***

In order to estimate the number of pig farms which are potentially affected by the Nitrate directive the most important Member States in pigmeat production have been chosen:

Germany; Denmark, Belgium; Spain; France; Italy; Netherlands and UK. On the whole, these eight countries represent 91% of the pig population in the EU.

In the first step of the analysis, the Farm Structure Survey of the single countries has been processed. These figures permit to calculate the share of pig population raised in farms whose stocking rate is higher than 17 pigs per hectare, corresponding to the limit of 170 N kg/ha that is established for the NVZ.

The assumption that the whole country is defined as NVZ is valid only for Germany, the Netherlands and Denmark while in the other five States only part of the territory has been declared as vulnerable. Therefore, in the second step the number of pigs raised in the NVZs of these countries has been estimated, using the REGIO databank made available by EUROSTAT. The final results of this analysis are reported in the Table 10.

**Table 10 - Share of pigs affected by the Nitrate Directive in selected countries (2005)**

	<b>BE</b>	<b>DK</b>	<b>DE</b>	<b>ES</b>
Total pigs (heads)	6,318,220	13,466,290	26,857,800	22,776,690
% pigs raised in NVZ	100.0	100.0	100.0	24.3
% of pigs affected	60.3	10.9	17.0	7.6
Pigs affected (heads)	3,809,620	1,470,300	4,558,380	1,727,397
	<b>FR</b>	<b>IT</b>	<b>NL</b>	<b>UK</b>
Total pigs (heads)	14,792,810	8,757,640	11,311,560	4,860,400
% pigs raised in NVZ	74.5	64.2	100.0	66.1
% of pigs affected	23.5	37.2	79.4	23.8
Pigs affected (heads)	3,474,032	3,264,236	8,978,870	1,157,649

*Source: Elaborated by CRPA on Eurostat Farm Structure Survey and REGIO databank 2005.*

In the Netherlands and Belgium the majority of pigs are raised in NVZs and in farms exceeding the 170 kg N. Unlike the fact that Denmark is designated completely as vulnerable, this country is characterised by a very low percentage of pigs (11%) on farms with a stocking rate above the limits indicated. This has certainly to be attributed to the more equal territorial distribution of pigs farms and to the strict application of the Nitrate Directive which has imposed the obligation for Danish pigs farms to own or rent the land on which the slurry is to be spread. Also Spain has a low share of pigs affected, but this is due to the quite scattered pattern of NVZs.

#### *Impact of improved compliance with Nitrates Directive on EU pig farms costs*

In several countries the costs have been calculated which pig farmers have to face in order to comply with the Nitrate Directive. A literature inventory has enabled to establish the

cost increase related to compliance with the Nitrate Directive in each of the eight countries. The compliance costs are derived from respective publications ("Landwirtschaftliches Wochenblatt ", ; De Hoop and Daatselaar, 2004; Gourmelen, 2006; Christiansen, 2007; De Roest *et al.*, 2007; Penlington, 2007). The percentage increase per kg pigmeat has been estimated aggregating these cost estimates to the pig production cost calculations carried out by Interpig, a network of European research institutes coordinated by the Meat and Livestock Commission and the British Pig Executive.

**Table 11 - Production costs of EU pig farms and cost increase due to compliance with Nitrates Directive**

	<b>BE</b>	<b>DK</b>	<b>DE</b>	<b>ES</b>	<b>FR</b>	<b>IT</b>	<b>NL</b>	<b>UK</b>
Feed	0.685	0.680	0.696	0.852	0.730	0.994	0.693	0.814
Breeding, vet/med and energy	0.094	0.105	0.159	0.122	0.109	0.115	0.143	0.109
Labour	0.125	0.165	0.200	0.124	0.177	0.137	0.174	0.199
Building, finance and misc	0.342	0.468	0.475	0.409	0.397	0.367	0.452	0.617
Total costs	1.245	1.418	1.530	1.508	1.413	1.613	1.461	1.740
Compliance costs with Nitrate Directive (€/kg)	0.076	0.046	0.059	0.076	0.087	0.134	0.044	0.090
<b>% cost increase</b>	<b>3.50</b>	<b>3.21</b>	<b>3.86</b>	<b>8.87</b>	<b>6.16</b>	<b>8.29</b>	<b>2.98</b>	<b>5.18</b>

Sources: CRPA estimates and Interpig data BPEX, 2006.

The presented cost increases are valid for those pig farms which do not yet comply with the Nitrate Directive. Of course the degree of compliance among the different Member States differ significantly. In Italy where only recently an acceleration of the implementation is taking place the degree of compliance can be estimated in only 20%, but in Denmark where since a longer time a rather strict application has been imposed on livestock farmers, the degree of compliance is very high. According to the assessments carried out in the eight countries, other countries reach degrees of compliance ranging between these two extreme values.

In order to obtain a percentage cost increase at sector level for each country, two crucial variables have been considered: the degree of compliance with the Nitrate Directive and the percentage share of affected pigs on the total number of pigs in the country.

As Table 12 signals, Italy, the Netherlands and Belgium will still have to face a cost increase which varies from 1.1% to 2.5%. Other countries show limited cost increases, either because of a limited number of affected pigs (Denmark), or because of a relatively small number of pigs present in NVZs (Spain) or due to a high degree of compliance (United Kingdom).



**Table 12 - Cost increase for affected pig farms and EU pig sector due to the application of the Nitrates Directive, 2005**

	<b>BE</b>	<b>DK</b>	<b>DE</b>	<b>ES</b>
% of pigs in NVZ	100.0	100.0	100.0	24.3
% of pigs affected by cost increase	60.3	10.9	17.0	7.6
% degree of compliance	0.50	0.80	0.85	0.20
% cost incr. per kg meat	3.5	3.2	3.9	8.9
<b>% cost increase for sector</b>	<b>1.1</b>	<b>0.1</b>	<b>0.1</b>	<b>0.5</b>
	<b>FR</b>	<b>IT</b>	<b>NL</b>	<b>UK</b>
% of pigs in NVZ	74.5	64.2	100.0	66.1
% of pigs affected by cost increase	23.5	37.3	79.4	23.8
% degree of compliance	0.70	0.20	0.50	0.90
% cost incr. per kg meat	6.2	8.3	3.0	5.2
<b>% cost increase for sector</b>	<b>0.4</b>	<b>2.5</b>	<b>1.2</b>	<b>0.1</b>

Source: Elaborated by CRPA on BPEX, and EUROSTAT.

Supposing for the remaining Member States a zero cost increase, the EU pig sector as a whole would still have to face an additional cost of 0.55% in order to reach full compliance with the Nitrate Directive.

#### *Impact of US regulations against water pollution (Clean Water Act)*

In the US 90% of the pig herds are raised in farms having more than 1,000 pigs, and 54% in larger operation with more than 5,000 heads. The greatest concentration of pigs exist in the Northcentral states (Iowa; Minnesota, North Carolina).

The present analysis has estimated the costs of compliance with regulations concerning water quality in the US for pig farms typical of Iowa. This state was chosen because it is the leading pig producing state in the U.S. The average pig operation size in this State is approximately 4,300 head, well above the threshold size to be considered a Concentrated Animal Feeding Operation (CAFO) according to the Clean Water Act (see the box below for more details).

It is important to note that the CAFO regulations currently affect a small percentage of livestock operations, but potentially a large part of US pig herd. The USDA inventory referring to 2006 shows that farms with more than 2,000 heads are only 7.8% of all pig operations in the US, but they account for 80% of the total pig population.

The primary manifestation of environmental regulations for livestock agriculture in the U.S. is the requirement to develop and follow a Comprehensive Nutrient Management Plan (CNMP) in order to comply with the Environmental Protection Agency's Clean Water Act regulatory requirements.

The United States Department of Agriculture (USDA) has estimated the costs for implementing a successful CNMP. The CNMP costs associated with pig operations, are an average cost of all pig farms in the U.S. The national estimates for the CNMP were adjusted from a per AU basis (US\$44) to a per 45.4 kg of gain basis (US\$1.57) to be consistent with the available financial data for pig farms. The final result is that the cost of compliance translates into a 3.54% increase in total production costs for farms affected by the CWA.

As 54% of the US pig population are raised in farms with more than 5,000 pigs and the degree of compliance equals 43.6% the total sector cost increase for pigs in the USA to be attributed to the Clean Water Act is 1.08%. If we compare this to the cost increase of full compliance with the Nitrate Directive in the EU which has been calculated in 0.454%, we notice that the CWA obligations in the US have a stronger economic impact on the pig sector.

### ***Animal Welfare: evaluated standards and cost implications***

Actually, the pig sector is completely ruled at EU by the directives 91/630/CEE, 2001/88/CE and 2001/93/CE, which are part of the Cross-Compliance policy being inserted in Annex III of Regulation 1782/03.

The main aspects of these directives are: prohibition to (a) tie sows and gilts; (b) use a complete slatted floor for sows and gilts; (c) isolate the sow during the period between 4 weeks after insemination and the week before farrowing with a minimum space allowance of 2.25 per m<sup>2</sup> for sows and 1.64 m<sup>2</sup> for gilt; (d) maximum stocking rates for different pig categories and (e) minimum standards for slatted floors. Of all above mentioned measures the most incisive cost increase may be caused by the obligatory group housing of sows. The reason is that all other measures already have a high rate of compliance in the EU (Enting, 2006).

Therefore, in the following an analysis will be presented of the possible cost increase per kg pig meat of the switch over of individual crates of sows to the group housing, taking also into account the minimum space per head required by the EU regulation.

Two practical examples below illustrate the consequences for a closed cycle pig farm. First, a comparison between the old conventional housing system with sows housed in individual crates with an investment in a new pig farm where pigs are housed in groups 4 weeks after insemination. Second, an adjustment of an existing pig farm to the new housing requirements for sows.

Technical details are presented in Table 1 13 and the economic effects are shown in  
An adjustment of an existing pig farm to the new requirements has a more incisive impact on the economy of the farm, as the end solution is not as optimal compared to a new building The production capacity has been presumed to be unchanged and the pig farmer is only adjusting the pregnancy parts of the farm building. Although the cost increase is higher, the cost impact also in this remains rather limited and well below 1%. Hence, the animal

welfare directives which are an integral part of the cross-compliance policy does not have a significant impact on production costs.

Table 14. The new requirements would cause an increase of the investments in the two pregnancy phases of the sows of 12% per sow place, but as these two phases are representing only 10.8% of the total investment of a new closed cycle pig farm the total investments rise by only 1.3%. The expected increase in total production costs (per kg pig meat) is limited to 0.1%.

**Table 13 - Investments cost for close cycle pig housing**

	n. places	Housing system with individual crates for sows		Group housing of sows after four weeks of insemination	
		€/place	Investment €	€/place	Investment €
Insemination 1 <sup>st</sup> phase	46	1,884	86,664	2,025	93,150
Pregnancy 2 <sup>nd</sup> phase	61	1,027	62,647	1,257	76,677
Farrowing	30	3,684	110,520	3,684	110,520
Weaning	285	259	73,815	259	73,815
Gilts in first phase	24	600	14,400	600	14,400
Growing up to 50 kg	368	320	117,760	320	117,760
1 <sup>st</sup> phase fattening	450	480	216,000	480	216,000
2 <sup>nd</sup> phase fattening	720	700	504,000	700	504,000
Other investments			370,862		370,862
Total investment			1,556,668		1,577,184

Source: CRPA.

An adjustment of an existing pig farm to the new requirements has a more incisive impact on the economy of the farm, as the end solution is not as optimal compared to a new building. The production capacity has been presumed to be unchanged and the pig farmer is only adjusting the pregnancy parts of the farm building. Although the cost increase is higher, the cost impact also in this remains rather limited and well below 1%. Hence, the animal welfare directives which are an integral part of the cross-compliance policy does not have a significant impact on production costs.

**Table 14 - Difference in production costs by two adjustment strategies**

	(1) Investment in a new pig farm which comply with the group housing requirements for sows		(2) Adjustment of an existing pig farm to the new animal welfare requirements of sows	
	Before	After	Before	After

	€/kg	€/kg	€/kg	€/kg
Feed	0.687	0.687	0.687	0.687
Labour	0.217	0.217	0.217	0.217
Other variable costs	0.254	0.254	0.254	0.254
<b>Total monetary costs</b>	<b>1.158</b>	<b>1.158</b>	<b>1.158</b>	<b>1.158</b>
Interests on ant. Capital	0.014	0.014	0.014	0.014
Interests and depreciation,	0.162	0.164	0.162	0.172
<b>Total costs of production</b>	<b>1.335</b>	<b>1.337</b>	<b>1.335</b>	<b>1.344</b>

Source: CRPA.

Considering the pig production cost calculations carried out by Interpig, and the different degrees of compliance among the main EU producers countries, a 0.11% increase has been estimated for the EU pig sector (Table 15).

**Table 15 - Production costs of pigmeat and percentage cost increase due to compliance with Animal Welfare Directive**

	BE	DK	DE	ES	FR	IT	NL	UK
Feed	0,685	0,680	0,696	0,852	0,730	0,994	0,693	0,814
Breeding, vet/med and energy	0,094	0,105	0,159	0,122	0,109	0,115	0,143	0,109
Labour	0,125	0,165	0,200	0,124	0,177	0,137	0,174	0,199
Building, finance and misc	0,342	0,468	0,475	0,409	0,397	0,367	0,452	0,617
<b>Total costs</b>	<b>1,245</b>	<b>1,418</b>	<b>1,530</b>	<b>1,508</b>	<b>1,413</b>	<b>1,613</b>	<b>1,461</b>	<b>1,740</b>
cost increase €/kg	0,011	0,011	0,011	0,011	0,011	0,011	0,011	0,011
Cost increase	0,90%	0,79%	0,74%	0,75%	0,80%	0,70%	0,77%	0,65%
degree of compliance	80%	90%	80%	50%	50%	50%	50%	95%
% cost increase sector	0,09%	0,04%	0,07%	0,19%	0,20%	0,17%	0,19%	0,02%

Source: Elaborated by CRPA.

### **Standards and external competitiveness: Pig meat sector**

This section summarises the trade effects simulated along four scenarios by the GTAP model in response to full compliance in the EU to Nitrate Directive, Animal Welfare and a combined effect of these (scenario 1-3), as well as the effect of compliance to the Clear Water Act in the US (Scenario 4). The results are presented in Table 16 .

**Table 16 - Percentage changes in pig meat sector trade due to full compliance to various standards**

Scenario	EU Import	EU Export	exports of which to...				Total world trade
			USA	Japan	Rest of OECD	Rest of World	

1 Nitrate EU: 100%	4,37	-3,03	-3,10	-1,15	-3,83	-3,64	0,14
2 Animal Welfare EU: 100%	0,83	-0,69	-0,60	-0,38	-0,71	-0,83	0,01
3 Nitrate EU: 100% and Animal Welfare EU: 100%	5,24	-3,70	-3,66	-1,53	-4,51	-4,44	0,16
4 Clear Water Act in Us: 100%	-0,69	1,85	4,47	2,12	2,06	1,25	-0,65

Increasing costs induced by a full Nitrate Directive compliance in the EU, certainly may affect international trade flows in pig meat and the market shares held by the main exporter countries. These effects have been simulated with the GTAP model.

As follows from the results of Scenario 1, a full compliance with the Nitrate Directive leads to a 3% decrease of both market share and exported volumes of the EU, while the effect on the level of production could feed a 4.4% higher demand for imported pigmeat. In the Japanese market, which is the first world export market, the loss of about 1.15% in the quantities traded by EU would stimulate a increase of the demand for pigmeat coming from Brazil, the US, Canada and other countries at a rate of 0.27% each. In the other OECD countries the decrease of UE export has been estimated in 3.8%, which favours the competitive position of Brazil, Canada and the USA in these countries by about 1% each.

On the whole Brazil's export share gain would be higher than those of the other two main competitors. The gains of the three top exporters range from a maximum of 1% in the case of Brazil to a minimum of 0.3% of Canada. Increases in volume traded by these countries range within the same limits.

Following the results of Scenario 2, Animal Welfare regulations should affect EU competitiveness at a lower extent since its effect on pig farms production cost has been estimated to be limited to only a 0.1% increase. This would entail a 0.8% growth of EU imports and a decrease of exports equal to 0.7%.

Summing up the effects of both standards requirements (Scenario 3), an overall decrease of 3.7% would affect EU export. The loss in quantity on the Japanese market would be equal to 1.5% while export towards other OECD would decrease by 4.5%. As imports are concerned, a 5.24% growth of import is expected in large part due to the higher import flows coming from Brazil (+5.2%). On the whole Brazil would gain 1.2% of his global market share, while a 0.4 and 0.8% increase have been respectively estimated in favour of Canada and the USA.

The previous analysis has pointed out that the full implementation of the Clear Water Act requirements by the US pig sector would produce higher impacts than those expected in EU due to full compliance with the standards with the Nitrate directive. The different effects

are due first to the high share of the US pig herd raised in farms that are eligible to be classified as CAFOs and secondly by the rather new implementation of the CWA which generates a relatively low degree of compliance. The simulation results are presented under Scenario 4. The highest costs of full compliance with CWA regulations by most intensive pig farms, would affect the competitiveness of US on the beef world market entailing a 7.3% decrease of its pig meat exports. This gap left will be covered by the EU (+1.85%) and Brazil (+1.18%), which both would gain market share in particular on the Japanese market. Higher gains in market share are foreseen in the case of Canada, whose export would be stimulated by the increasing demand coming from USA.

### ***Conclusions***

The extent to which the Nitrate Directive may create extra costs to the pig sector depends on the pig density per hectare in each Member State, on the percentage of pigs present in Nitrate Vulnerable Zones and on the degree of compliance of pig farmers to the Nitrate Directive. These three data differ very much from country to country and explain primarily the very different sector cost increases for the pig sectors of EU Member States. The overall EU cost increase to be attributed to the pig sector due to attain full compliance with the Nitrate Directive has been estimated at 0.55%.

From a comparison with the impact of the Clean Water Act in the US it turns out that this act raises the cost for the American pig sector with 1.08%, an almost double cost effect compared to the impact of the Nitrate Directive in the EU. The reason for this substantial rise of costs has to be attributed to the large percentage of pig affected by this measure and its rather recent application to US pig farms, which still implies a rather low degree of compliance.

A calculation of the animal welfare regulations for pig farmers in the EU shows, that the cost increase is very limited. The reasons for this minor cost impact are a high degree of compliance with the standards and the limited rise of costs for farmers which still have to adapt their farm to the new legislation.

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