Costs of compliance with EU regulations and competitiveness of the EU dairy sector

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Abstract— **The introduction of cross-compliance mechanism in the European Union with its 2003 CAP-reform might affect the costs of production and thus competitiveness of the EU. Little evidence is available to asses the costs of compliance with regulations and it implication for trade. In this study a farm level competitiveness analysis of the impacts of the Nitrate Directive and the Identification & registration Directive focuses on the dairy sector in Germany, France, Italy, Netherlands and UK (within EU), and the US and New Zealand (outside EU). The findings from this study are integrated into a trade analysis which assesses the impact of compliance costs on competitiveness of the various trading nations in global trade. Representative farm studies were used as a basis for the cost increase calculations. Best-estimates of compliance are used from the existing literature and expert judgements. The negative impact of these measures (for nitrates, and animal identification and registration) on EU imports and exports are less than 3 percent. If a smaller increase in compliance takes place, these already relatively small trade impacts will be further diminished. When the standards for nitrate pollution taken by the US and New Zealand are taken into account along with full compliance assumption in all countries analysed, this would only slightly improve the EU exports. The trade impacts obtained when no changes are assumed to happen in key competitor countries can thus be argued as providing the upper bound of the likely trade impacts.**

Keywords— **Compliance, dairy sector, GTAP**

I. INTRODUCTION

The 2003 Mid-Term Review (MTR) of the Common Agricultural Policy (CAP) introduced a number of adjustments to agricultural support. One of the most substantive changes was the introduction of a system of decoupled payments per farm (known as the Single Farm Payment). These decoupled payments were made conditional on recipients meeting environmental, food safety, animal and plant health, animal welfare requirements as well as standards of good agricultural and environmental practice (cross-compliance). Cross-compliance includes a large set of requirements, partly pre-existing, which potentially all might affect the costs of production and thus competitiveness.

In terms of international competitiveness, the EU's presence on the world market is strong for all the major dairy products: butter, cheeses, skimmed and whole milk powder. In 2005, the value of total dairy exports out of the EU was EUR 5.4 billion – for 2,5 million tonnes of products. From EU-15, Belgium, Denmark, France, Germany, the UK, Spain, Italy and the Netherlands) make up 88% of the European export of dairy products. In the EU the dairy production represents the first largest agricultural sector (EC, 2006). Quotas and environmental restrictions, however, have limited the EU's dairy production; moreover, its dairy manufacturing sector has tended to focus on specialty cheeses exported and sold at premium prices. Australia and New Zealand now control a growing share of world trade in dairy products.

Would the global competitiveness of the sector be influenced due to increase in costs of compliance with regulations? Not much of evidence is available to asses the costs of compliance with regulations. The recent EU study assessing the administrative burden on farms arising from the CAP identifies that the cross-compliance controls represent 1% of the total administrative costs (DG-AGRI, 2007), however costs could rise from changes in production strategies to comply with regulations. Kuik (2006) performs a review of studies which estimate costs to farmers of measures to reduce nitrogen pollution in agriculture across Europe. The differences in costs per hectare from €6 to €236 are caused by industry structure (dairy, beef, pigs and poultry, crops, mixed), livestock intensity, historical rates of fertilizer application and the vulnerability of soils to nitrate leaching. In terms of the trade implications of environmental regulations, the previous research has mainly investigated the effects within the manufacturing sector (see e.g. Xu, 2000; Le Roux *et al.*, 2008 for an overview of studies). In agriculture, the work of Cassells and Meister (2001) is of direct relevance, which simulates the effects of compliance to water quality standards in New Zealand dairy sector.

The contribution of this study is that it analyses the extent to which the imposition of farming standards, through the cross compliance system, gives rise to on-farm costs which in turn affect the competitiveness of farm businesses with competitors on the world market. A farm level competitiveness analysis of the impacts of the Nitrate Directive and the Identification & registration Directive focuses on Germany, France, Italy, Netherlands and UK (within EU), and the US and New Zealand (outside EU) and integrates these findings into the analysis of trade thereby assessing external competitiveness. This analysis is of particular importance in light of the CAP Health Check which was recently launched by the European Commission. Political decisions are likely to be highly influenced by debates about the relative costs and benefits of doing so.

The paper is structured as follows. Section 2 outlines the main steps undertaken in the analysis and explains motivations for the assumptions made whereas section 3 describes the data employed in empirical work. Section 4 presents calculation of additional costs associated with three standards in selected EU countries. These cost assessments, scaled up to the sector level, are used for the external competitiveness analysis presented in section 5. Section 6 concludes.

II. METHODOLOGICAL APPROACH

The concept of competitiveness has no unique definition and is used in a broad set of contexts and levels of aggregation (firm, product, country, industry). The methodological approach and design of this study is based on qualitative as well as quantitative modelling assessments, differentiating with regard to farm, sector and global levels of competitiveness.

Farm competitiveness addresses the comparison of firms on one market: one firm is more competitive compared to one other if it can supply a product at lower costs, without affecting its overall profitability on the long term. In the case of farms, the profitability can therefore be approached by the farm's gross income (revenues and subsidies) minus the costs of variable and (quasi-) fixed factors.

If compliance to standards affects production costs at the farm-level, aggregate agricultural production is affected, shifting production from the most affected farm groups to the least affected ones. At the aggregate level, these production shifts translate into a shift of the supply curve, i.e. a supply response. The supply response, on its turn, displaces the equilibrium between supply, demand and international trade. Differing standards and degrees of compliance to standards, and heterogeneity of farming conditions can change the market share of a trading partner within a sector. Market share between sectors is also affected, due to substitution and complementarity and spill-over effects between produced commodities in the economy. When considering potential cost implications due to the compliance with standards, it needs to be noted that implementation of standards varies considerably between Member States. Therefore the assessment of potential costs is done for particular member states. In addition, to assure comparability of competitiveness between EU and non-EU countries, implementation of comparable standards and potential cost implications is provided for New Zealand and USA. To account for effects that occur at farm as well as sector and economy level, the following four steps are taken in the analysis.

In Step 1, the outcomes of seminars and discussions with experts and findings obtained from other projects and a literature review are used to establish the initial level of compliance to Nitrate Directive, the Identification and Registration requirements and the food safety issue (in particular the impact of prohibited use of milk yield growth promoters in the EU) and to suggest the degree of possible improvement. The selection of the standards analysed is based on several considerations: information about the importance of standards, best estimates of degrees of compliance and qualitative assessment of effects (marginal, limited, significant) and costs (negligible, low, and potentially significant) across standards, sectors and countries. The results of qualitative assessments for selected EU countries from Jongeneel *et al.* (2007) are used.

In Step 2, a bottom-up approach was followed determining the percentage cost increase due to compliance starting from farm level. To define the number of affected dairy farms (animals) in the sector of each European country, density of livestock (≥2 livestock unites per ha)[1] located in Nitrate Vulnerable Zones was approximated by dividing the total grassland area in the NVZs by the average land base (in hectares) of livestock farms. Subsequently this number is multiplied by the estimated share of specialized dairy farms in the total number of livestock farms, which yields a proxy for the number of dairy farms in the NVZ.

Costs associated with achieving compliance with mandatory cross compliance standards can occur in the following ways:

a) Investment costs: need to purchase new equipment, build manure storage facilities, etc.

b) Production costs: costs of replacement of eartags, labour costs needed for an application for a cattle passport in case of birth, to check animal identification, keep registries up to date and archive them for 10 years, costs of manure management (transportation and spreading, purchasing rights to spread on additional land), etc.

c) Administrative costs: time needed to become familiar with new requirements/ procedures/ controls (training events etc.); prepare controls and inspection time

d) Non-compliance costs: deduction made from the SFP, potential loss of accreditation.

[1] Farms with lower densities than 2 LU/ha (‘extensive farms’) are assumed to face no significant cost increases. An exception are those extensive farms which are in a NVZ area, where they are assumed to in principle also face the record keeping costs (irrespective of their density).

Thus, when accounting for additional costs associated with achieving compliance with mandatory standards, the above mentioned categories are assessed.

During Step 3 an up-scaling procedure is employed to derive the percentage cost increase at the national level. In EU countries, the percentage costs increase as a whole is determined by a production weighted share of affected and non-affected farms. The exception to the above procedure concerns the estimates of compliance to the Nitrate directive in Italy (based on case study in two provinces, see De Roest *et al.* (2007)). Under these assumptions the aggregation of costs to the national level is done for all sectors and countries which are used in modeling under step four.

In Step 4, a multiregion, multisector, computable general equilibrium (CGE) model GTAP (Global Trade Analysis Project), which is capable to take into account the various behavioural responses and related market adjustments, is exploited to determine the impacts of increases in costs of production on the EU’s and other countries trade position. The GTAP-model of distinguishes 87 regions, 57 sectors and used regional databases derived from individual country input-output tables based on the year 2001. From the EU-15, only Member States which have an EU export share of more than 5% are made compliant to the standards. Other countries are too small to have an effect on the European competitiveness. The remaining countries are aggregated into: (i) the rest of OECD (ROECD) countries and (ii) the rest of the world (ROW).

There are a number of assumptions made in the model that are relevant to this study. The model assumes rational profit maximizing producer behaviour, like most production models based on micro economic theory do. It is known however, that in agriculture farmers might, at least in the short term, behave sometimes in an adverse manner. This can imply that the burden of the calculated cost increases is partly or fully carried by family labor rather than passed on to buyers of farm products. To the extent that this phenomenon yet occurs, the calculations given below are likely to give an upper bound of the impacts, where the really observed impacts on trade patterns might be smaller than the predicted ones.

The model allows simulating the cost increase at the sector level by imposing a reduction in a sector’s factor productivity, which could potentially be done for all primary input factors distinguished in GTAP. When a breakdown of costs is not available (into land, capital, unskilled labour, skilled labour, capital and natural resources), like in our case, the overall costs of production increase is proxied by total factor productivity shift (variable AO in GTAP notation). This means that the input requirements for producing a given level of output are assumed to be uniformly increased.

III. DATA

The analysis is performed for selected EU-countries, EU-15 as a whole, and such non-EU countries as US and New Zealand, which are important competitors of the EU in the dairy sector. The following major data sources are used in the analysis. For a single EU country, the 2003 year data from specialized dairy farms (type 41) have been processed from the Farm Accountancy Data Network (FADN). The *typical* farm data in 2001 from the International Farm Comparison Network (IFCN, see Hemme, 2002) are used for farm competitiveness analysis, presented in Table 2. The advantage of these data is that they have been harmonized across countries and distinguish family labour costs, thereby allowing focusing on the net results. The data for Italian specialized farms are not in the IFCN network before 2005. This lack of data is compensated by the case study (De Roest *et al.*, 2007). For non-EU countries, the 2005 year farm as well as regional data were used from the United States Department of Agriculture (USDA), and Ministry of Agriculture for New Zealand and regional authorities.

The GTAP model version in this analysis uses 2001 as a base year. Since the 2003 reform in the dairy sector was not yet accounted for, a price decrease in the base year of 2001 was introduced. The improvement in compliance is estimated as the change in compliance as compared to 2005, the year for which best estimates of compliance could be obtained. The results of the GTAP model are then interpreted as estimates of improvement in compliance since 2005 are evaluated as if they are happening in 2001 (the GTAP base year data). For this reason percentage changes as compared to the baseline scenario are analysed and not absolute numbers.

IV. EVALUATED STANDARDS AND COST IMPLICATIONS

Three standards have been selected for detail analysis of costs since these standards were expected to be most influential for the dairy sector, following the study of Jongeneel *et al.*, (2007). Jongeneel *et al.*, 2007 conclude that none of the EU’s key competitors (the United States and New Zealand) has a system of requirements comparable to the EU’s one. A comparative analysis covering all the themes addressed in the SMRs and GAECs shows that in general the intensity of regulation is less in these countries as compared to the EU. For the U.S. case 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 is analysed. For the case of New Zealand the effects of water quality regulations is studied. Although the policy-approaches in non-EU countries currently rely more on voluntary actions, more stringent forms of regulation might be introduced in the future. Therefore scenarios simulating effect of the Nitrate Directive will consider changes in regulations for key competitor countries.

A. Nitrates Directive

The Nitrate Directive is perceived by farmers as one of the most restrictive standards facing EU dairy farmers. The Nitrate Directive (91/676/EEC) was adopted in 1991 aiming at the protection of waters against pollution by nitrate from agricultural sources. If land is located within a Nitrate Vulnerable Zone (NVZ), the farmer must comply with NVZ Action Programme Measures which limit the organic manure loading per hectare (250 kg total N on grassland in any NVZ and 170 kg total N for non-grass crops in any NVZ) thereby limiting the disposal of manure by animals while grazing and require sufficient slurry storage facilities (or alternative arrangements) to cater for the closed period (see also Jongeneel *et al.*, 2007 for further details).

In the US, the approach toward managing the environmental impact from farming has been largely voluntary, or with compliance being a condition for cost-sharing assistance with best management practices.

The Clean Water Act (CWA), which was originally focused on point sources of pollution, has been expanded to non-point pollution, with agriculture identified as one of the key sectors. The farms that feed animals primarily in confinement are designated by Clean Water Act rules as Concentrated Animal Feeding Operations (CAFOs) and are the focus of water quality regulations at the federal and state levels. However, it was not until 2002 that the federal government issued specific rules governing CAFO's, requiring the design and implementation of a comprehensive nutrient management plan. CAFOs are treated as a regulation 'similar' to the EU's Nitrate Directive. Since only 2 percent of all confined livestock operations are CAFO's, this policy currently only affects a minor (0.04%) number of dairy farms.

In New Zealand effluent from the farm is to be disposed on the land (after pounding) and fertilizer applications should follow a Code of Good Practice. The latter states manure discharge to be a controlled activity, where the rate of application may not exceed 150kg N per ha annually (and no more than 50 kg ha within a period of 24 hours), buffer zones should be respected and runoff and pounding of effluent should be avoided. Because the issue of nutrients derived from intensive farming has become a big concern a private-public partnership tries to come up with self-regulation (partnership includes nationwide dairy co-operative Fonterra as well as regional councils).

As follows from section 2, the bottom-up procedure was followed to assess the costs estimates starting from identifying the relevant number of dairy farms affected by the regulation (with a livestock density per hectare $\geq$ 2). Next, initial compliance levels, costs of compliance with the regulation for affected farms and the expected final degree of compliance are defined. As regards the cost measures for the selected EU countries we relied on per hectare cost estimates based on the Kuik (2006). The only exception to this is that the requirement to keep record of manure applications are (to our information) not yet included in the Kuik estimates. These are estimated to be €150 per (dairy) farm in a NVZ-area, and are added separately. To translate the percentage of additional costs of compliance to total costs at the sector level, both affected and non-affected farms are accounted for. Additional costs of compliance for the affected farms are calculated taking into account the base year level and the assumption about final degree of compliance. The costs at the farm and sector level are presented in Table 1 (only selected countries are presented) along the three scenarios: (1) all farms improve their degree of compliance in such a way that they all achieve full compliance; (2) all affected farms improve their degree of compliance with 20% (to a maximum of 100%) as compared to the base year level (prevailing degree of compliance); (3) the degree of compliance is increased in general with 10% (as compared to base year level), and additionally no country will have a degree of compliance lower than 75%. For Scenario 1, the percentage increase in total production associated with the additional costs necessary to achieve full compliance, varies between 0.099 till 6.8 percent of the total production costs. The absolute cost increases for this group varied from €419 per farm to €8837 per farm. In reality this effect might be somewhat lower, since (temporary) derogation provisions are not taken into account. Here it is assumed that at specialized dairy farms all production costs can be related to dairy production. Moreover, it should be noted that many of the less intensive specialised dairy farms, as well as the non-specialized dairy farms are assumed to have zero compliance costs. The highest percentage cost increase was calculated for Italy on the base of a case study carried in two northern regions Lombardy and Emilia-Romagna for dairy farms of different size and structure exercising various manure management systems (see De Roest *et al.*, 2007). As regards the costs associated with similar standards in New Zealand, the estimates from Cassells and Meister (2001) were updated (see Meister, 2006). The farm monitoring data (MAF, 2005) providing data on categories of total costs (in terms of $/head of cow) are used for each of the 21 dairy regions in New Zealand in year 2005. Compliance costs relating to water quality regulations are calculated at the farm level for the land-based disposal of dairy shed effluent. The percentage of farms that still had to comply for the period 2005/2006 is assessed to be 15%. Regional differences in average herd sizes and in consent and monitoring costs are incorporated into the analysis. Compliance costs at the farm level are then aggregated to obtain a total cost for the New Zealand dairy industry to comply with water quality regulations. From this total cost an estimate is made of the compliance costs per kilogram of Milk Solids produced. The national dairy farm budget is used to calculate the percentage costs increase at the farm level which amounts to 3.2% (additional of 8.66 cts/kg milk solids to the total of 2.77 $/kg milk solids). For the industry as a whole the percentage costs increase is 0.5%, given that 85% of farms are already compliant.

Table 1: Calculated cost of production increases in selected EU Member States due to compliance with the Nitrates Directive standard

		France	Germany	Italy	Nether-lands	United Kingdom
a	Revised cost estimate €/ha dairy farms (using all previous studies), in prices of 2003	50.0	50.0	50.0	105.0	110.3
b	Per annum record keeping costs (€ per farm)	150.0	150.0	150.0	150.0	150.0
c	Nitrate directive costs € per farm	6330	2119	11046	4694	8381
d	Total costs (per farm) as in FADN database 2003	121.2	112.6	184.1	177.8	219.5
e	Estimated prevailing degree of compliance	0.40	0.60	0.20	0.75	0.95
f	% Nitrate directive costs/ 'corrected' total farm costs =e*c/d*100%	2.09	1.13	1.20	1.98	3.63
g	Share of specialized dairy farms in total milk production (based on output value)	0.05	0.23	0.85	0.79	0.52
	Scenario 1: FULL COMPLIANCE					
h	Final level of compliance	1.00	1.00	1.00	1.00	1.00
i	Calculated additional costs per farm (associated with achieving full compliance) =(h-e)*c	3798	848	8837	1174	419
j	% Additional costs per farm associated with full compliance to Nitrate Directive =i/d*100%	3.13	0.75	6.80	0.66	0.19
k	Approximated additional total sector cost increase (full compliance), % =q*j	0.166	0.171	0.419	0.522	0.099
	Scenario 2: 20% INCREASE IN COMPLIANCE					
l	Final level of compliance	0.48	0.72	0.24	0.90	1.00
m	Approximated additional total sector cost increase, % =(l-e)*c/d*100%	0.022	0.051	0.398	0.313	0.099
	Scenario 3: 10% INCREASE IN COMPLIANCE and COMPLIANCE >75%					
n	Final level of compliance	0.75	0.75	0.75	0.825	1.00
o	Approximated additional total sector cost increase, % = (n-e)*c/d*100%)	0.097	0.064	0.288	0.157	0.099

Source: own calculations following the procedure described above; based on data from EU-FADN, DG AGRI G3 and De Roest *et al.*, 2007.

Two typical dairy farms from Wisconsin and California were chosen for the analysis not only because they are the top two dairy states, but also because they represent two distinct milk production systems. Wisconsin dairy farming is typical of traditional smaller dairy farm (92 cows), whereas Californian modern farm has 980 cows in 2006. For the calculation of costs per farm, costs of nutrient management, keeping costs, off-farm transport costs, land treatment and manure costs are accounted for amounting on average €7,308 per farm or €37 per animal on annual basis. Compliance with CNMP requirements costs on the typical Wisconsin dairy farm amounts to €1.37 per 100kg of milk produced (€0.31 per 100 kg in California). Based on the cost specification for 2 farms, this translates into an increase of 4.19% in total production costs and 7.46% of direct costs (1.84% and 3.33% for California). Given the low percentage of farms which are subject to CAFO's and that about 44% of farms are already compliant, the percentage costs increase at the national level averages to 0.02%.

Table 2: Farm structure and level of competitiveness in selected countries in 2001

	New Zealand		United States		Germany		France		The Netherlands		United Kingdom
Codes as in Hemme (2002)	NZ-229	NZ-835	US-70WI	US-2100ID	DE-68	DE-650	FR-30	FR-70	NL-51	NL-90	UK-100h
Number of dairy cows, LU	229	835	70	2100	68	650	30	70	51	90	100
Share grassland, %	100	100	54	62	40	32	80	26	95	81	100
Milk production per cow, kg FCM	4200	4200	9900	9500	8049	8250	5863	7527	8326	8645	7531
Costs per 100 kg FCM, US $											
costs for means of production	7.60	9.54	22.91	18.48	22.44	20.36	17.99	20.71	19.20	18.12	18.78
labour costs	2.82	2.70	12.60	3.30	10.20	8.40	15.00	9.30	13.50	9.60	8.70
land costs	1.74	1.44	1.80	0.18	1.80	2.00	3.00	1.44	3.12	2.52	2.88
capital costs	1.75	1.54	1.96	2.59	2.38	1.96	2.06	2.10	1.82	1.26	1.96
total costs	13.91	15.22	39.27	24.55	36.82	32.73	38.05	33.55	37.64	31.50	32.32
variable costs	9.00	12.68	24.55	22.91	20.45	28.64	17.18	18.82	13.09	11.45	18.41
fixed costs	4.91	2.54	14.73	1.64	16.36	4.09	20.86	14.73	24.55	20.05	13.91
Revenue per 100 kg FCM, US $											
milk price	16.82	16.82	35.91	32.27	29.09	29.09	28.18	29.09	28.18	28.64	26.59
other returns	2.27	1.64	3.68	3.20	2.69	2.67	3.60	2.43	3.78	3.64	1.42
direct payments	0.00	0.00	0.82	0.16	1.31	1.96	1.31	2.21	0.49	0.82	2.54
total revenue	19.09	18.45	40.41	35.64	33.09	33.73	33.09	33.73	32.45	33.09	30.55
Results per 100 kg FCM in €											
gross margin (revenue – var.costs)	9.01	5.15	14.16	11.36	11.28	4.55	14.20	13.31	17.29	19.32	10.84
profitability (gross margin – fix. costs)	4.63	2.89	1.01	9.90	-3.33	0.89	-4.42	0.16	-4.63	1.42	-1.58
Additional costs of compliance to Nitrate Directive (see Table 1 for prevailing degree of compliance and further details)											
% Additional costs associated with full compliance to Nitrate Directive	3.2	3.2	4.20	2.00	0.75	0.75	3.13	3.13	0.66	0.66	0.19
profitability at full compliance, €/100kg	4.23	2.45	-0.46	9.46	-3.58	0.67	-5.49	-0.78	-4.85	1.23	-1.64
% in profitability	-8.6	-15.1	-144.7	-4.4	-7.4	-24.6	-24.1	-578.2	-4.8	-13.1	-3.5
gross margin, €/100kg	8.75	4.79	13.24	10.96	11.15	4.35	13.73	12.79	17.21	19.25	10.81
% in gross margin	-2.85	-7.03	-6.50	-3.60	-1.21	-4.22	-3.38	-3.95	-0.45	-0.35	-0.29

Note: FCM is milk adjusted for fat content. Source: based on data from Hemme (2002) and Table 1.

The example for two US farms of different size with various cost levels and structure providing the range of farm costs increase from 2% to 4.2% clearly illustrates that compliance can have different effects on individual farm performance and thus internal competitiveness. The farm level competitiveness analysis summarised in Table 2 gives some in-depth insights with respect to Nitrate Directive. Two typical farms from the countries under investigation were selected from the IFCN publication (Hemme, 2002) to represent different size (small and large) and structure. The percentage rates of cost increase presented in Table 1 are applied.

The costs and revenue data have been harmonized prior to analysis by the IFCN (measured in US $). The lowest line of Table 2 shows the impact of (full) compliance with the Nitrate Directive (or similar regulations outside the EU) on farm profitability and gross margin, bother are recalculated in EU €. As the table shows, small changes in costs can significantly affect gross margin and (even more so) profitability. The results for Italy are not presented in Table 2 since the data for Italian specialized farms are not in the IFCN network before 2005. As follows from the study of De Roest *et al.*, 2007 performed in two Northern regions Lombardy and Emilia-Romagna, milk production cost will due to the effects of the Nitrate Directive, increase by 8.4% in farms with 100 cows and by 6.7% in the larger ones (with 350 cows). Costs on farms in Emilia-Romagna increase less than in Lombardy (per 100 kg from € 35.74 to € 38.42 per 100 kg in Lombardy) since the number of animals in the area is significantly lower that makes it possible to spreading excess manure for agronomic purpose on additional sites which are closer than in Lombardy. In the short run, application of the Nitrates Directive regulations to farms in Lombardy and Emilia-Romagna may entail, in areas with a high animal concentration, the closure of less efficient or smaller farms. This will allow other farmers to use nearby lands suitable for manure and sludge spreading with reduced cost compared to use of farther lands. The fact that these farms produce less slurry and more manure will certainly help dairy farmers to dispose of waste more easily than pig farmers.

B. Identification and registration of farm animals

The EU Directives on Identification and Registration (I&R) of animals (92/102/EEG, and Regulations 911/2004, 1760/2000, and 21/2004) is one of the most frustrating requirements to the farmers (DG-AGRI, 2007). By far most time consuming is the check of animal identification especially in extensive farms or in cattle breeding, as animals are often outside and in different fields and sometimes difficult to approach, compared to dairy cows kept indoors. I&R of farm animals has significant degree of non-compliance, with 30% non-compliance not being an exception. Besides, the inclusion of animal I&R results is very demanding for controlling agencies (about 36 hours per farm for the RPA in England or 40 hours for the AID in the Netherlands, who controls most SMRs and soil organic matter).

The results of the cost estimates at farm level for five selected member states are presented in Table 3. First the total number of animals per farm is determined, assuming that per dairy cow about 0.8 number of other animals (heifers/bulls) is present at the farm. Moreover it is assumed that 95% of the dairy cows give birth to a calf, which has to be registered. In addition it is assumed that there is an eartag loss rate of 15%, which requires a proper and timely eartag replacement. The costs consist of the eartag costs and the labor (per animal) required for registration.

The procedure of approximating the additional costs is similar to that for the Nitrate Directive. In all cases the estimated additional cost are below 0.14%. Since the percentage cost increases related to the I&R directive are relatively marginal, other scenarios are not considered.

Table 3: Estimated costs of I&R for the dairy sector (€) for selected EU Member States

Unit	France	Germany	Italy	Nether-lands	United Kingdom
Number of specialized dairy farms (*1000)	63.7	73.6	40.8	21.7	21.6
Average farm size specialized dairy farms	67.1	52.7	30.1	45.1	88.5
Average number of animals/farm	76.5	77.7	81.8	114.2	158.6
Estimated number of calves born	40.4	41.0	43.2	60.3	83.7
Estimated eartag loss (15% loss rate)	11.5	11.7	12.3	17.1	23.8
Labour costs per animal	1.75	1.75	12.00	1.75	*
I&R costs per animal (costs tags)	1.80	2.92	3.00	2.75	4.20
Total I&R costs per farm	192.9*	246.0	831.8	348.3	451.4
Total costs (per farm) as in FADN database 2003, €1000	121.2	112.6	184.1	177.8	219.5
Specialised costs (per farm) as in FADN database 2003, €1000	41.6	46.1	128.0	65.7	109.6
Estimated prevailing degree of compliance	0.9	0.65	0.7	0.9	0.7
'Corrected' costs per farm (excluding impl. Nitrate costs), €1000	121.0	112.4	183.5	177.5	219.2
% additional costs I&R / 'corrected' total farm costs	0.02	0.08	0.14	0.02	0.06

Note: For the UK no specific labour costs were distinguished. They are included in the costs per animal.
*Fixed costs of €9 per farm in France are accounted for.
Source: own calculations based on data from EU-FADN, DG AGRI G3.

C. Food safety (hormone use)

Consumer concerns as regards food safety have lead to hormone use prohibition in the EU. In the U.S. a recombinant bovine somatotropin (rBST), a growth hormone that stimulates milk production has been approved for use in dairy cows since 1994. Alongside the US BST (or rBST) is used by at least 16 other dairy producing countries (Jarvis, 2002). The EU, Canada and Japan rejected legal BST use, and also within the US the technique was (and still is) controversial, at least within certain groups and regions. See Jarvis (2002, 103) for further details.

Monsanto – the monopoly-supplier of the product (brand name: POSILAC) – reports that in 1999 about 13.000 US dairy farms were using BST, applying it to 9 million dairy cows (approximately 30% of the cows in supplemented herds). The use of this hormone leads to production increase and as follows from Tauer (2002), application of rBST in the first year may increase an average herd milk yield by 419-575 kg, whereas late adopters are able to directly realize a milk yield increase of about 480kg/animal.year. Jarvis (2002) who analyzed the potential effects of BST on world dairy markets, estimates that the total US milk supply increased by 3% due to the (pure) BST application[2].

Whereas BST will increase yields and thus revenues it simultaneously increases input use (feed) and thus costs (including the costs/fee for BST use farmers have to pay). In an ex-ante analysis Perrin (1991) estimated per unit cost savings varying from 0.5 to 4.4 percent, although milk yields were increasing by approximately 15% (note the simultaneous cost increase effect). Jarvis (2002, 109) using a slightly different approach provides a maximum per unit

[2]For comparative reasons note that the autonomous (genetic) milk yield increase is about 2% per annum. Where bST application creates a one-shot increase, genetic progress creates a continuous milk yield increase.

cost decline of 5% (per unit average). When simulating the trade impact of hormone use ban in the U.S. this 5% cost increase is assumed imposed on the U.S.

V. STANDARDS AND EXTERNAL COMPETITIVENESS

External competitiveness is analysed along seven scenarios. The first three scenarios in Table 4 simulate compliance to the Nitrate Directive in EU Member States at various levels of compliance (corresponds to Table 1). Scenario 4 simulates full compliance within the EU to the Nitrate Directive and similar regulations in the USA and New Zealand.

For the case of full compliance to Nitrate Directive in EU countries (scenario 1), the European dairy sector loses 0.71% of its export mainly to the rest of OECD and USA. Moreover, it increases its imports by 0.80%. As was already noted in the introduction, EU imports are playing a very limited role, and the main impact will be thus on exports. Since the GTAP model does not distinguish disaggregated dairy product markets, it is impossible to indicate how various product markets (e.g. butter, skimmed milk powder, whole milk powder, hard and soft cheeses, casein, etc.) will be affected. For example, the EU is known to export various speciality cheeses to the US market. The exports of such high value-added products are likely to be less affected than the 'average' dairy export product simulated within GTAP. The predicted export reduction of 0.70% of the EU to the US is therefore likely to be an upper bound. The extra imports may be an overestimation due to the way tariff rate quotas (TRQ) are modelled in GTAP. The other countries will increase their export in order to fill the gap the EU leaves. However, the total traded volume decreases with 0.05%, which is quite small.

Table 4: Percentage changes in trade due to compliance to various standards

	Scenario	EU Import: total	EU Export: total	Exports of which to… USA	Rest of OECD	Rest of World	Total Trade
1	Nitrate EU: 100%	0.80	-0.71	-0.70	-0.77	-0.70	-0.05
2	Nitrate EU: +20%	0.51	-0.42	-0.45	-0.46	-0.40	-0.02
3	Nitrate EU: +10%, minimum 75%	0.40	-0.33	-0.37	-0.37	-0.31	-0.02
4	Nitrate EU and non-EU: 100%	0.30	-0.41	-0.63	-0.44	-0.38	-1.07
5	I&R EU : 100%	0.21	-0.15	-0.18	-0.18	-0.14	-0.01
6	I&R EU : 100% and Nitrate EU : 100%	1.01	-0.87	-0.89	-0.95	-0.85	-0.06
7	Ban on hormone use in US: 100%	-0.25	2.44	27.57	2.52	-0.80	0.24

Notes: Regional impacts are presented for the situation of EU being a net exporter.
Source: GTAP calculations.

Because of the lower costs for European farmers in Scenario 2 and 3 compared to the first scenario (see also Table 1) there is a smaller effect on the competitiveness of the European dairy sector. The decrease in export volume of 0.4% and 0.33% respectively. Because of the smaller price effect on the world market the total traded volume only reduces with 0.02%. The rest of the OECD and the rest of the world fill most of the reduced European export. In scenario 4, when countries fully comply with nitrate measures, the total trade reduces substantially by 3.13% whereas the total export of the EU increases by 1.08%, with the major (9.11%) exports increase to the U.S. Scenarios 5 and 6 report the simulation results of compliance of EU countries to the Identification & Registration standards. There are no costs for non-EU countries and slightly increased costs for EU countries resulting in the smallest of all the scenarios trade decline of 0.01%. A combined effect of full compliance of EU countries to Nitrate Directive and I&R leads to 0.6% loss of EU exports.

The last scenario 7 is different from the previous ones in that it takes the EU standard not to use the BsT milk yield enhancing hormone as given and simulates the impact when the US would apply to a similar standard (which it currently does not). As such it provides some insight into the 'opportunity costs' to the EU of the US not adopting a similar standard. As it turns out, a hormone ban in the US mainly affects U.S. trade, and profits the EU dairy sector with an increase is exports of 2.4%.

VI. CONCLUSIONS

In this study the impact of compliance to standards on cost of production is estimated, using a farm level analysis and taking into account actual farm accountancy data. Rather representative farm studies were done and used as a basis for the cost increase calculations. Best-estimates of compliance are used, but these still contain a certain degree of uncertainty. In a number of cases alternative approaches and the different sources were used to cross-check both cost of production and degree of compliance estimates in order to test for the robustness in terms of order of magnitude.

As regards the impact of the Nitrate and Identification and registration standards on production, clearly the Nitrate Directive has the most impact. At sectoral level for nitrate percentage cost of production increases of 0.1 to 0.6% were found, with rates varying over countries and with respect to variations in the prevailing degree of compliance, as well as the assumed improvement in compliance. At farm level the Nitrate Directive might have even much stronger impacts than at sector level. As compared to the Nitrate Directive the estimated percentage costs increases associated with full compliance to the Identification and Registration standard was less than 0.15% and thus rather marginal.

The impact of the Nitrate Directive on the EU's external competitiveness can be described by the changes in diary exports and imports. Due to the relative cost increase associated with improved compliance to the Nitrate Directive, EU exports are projected to decline by a maximum of 0.71 percent, whereas imports increase by a maximum of 0.80%. So the overall effects are limited, with the impact on exports being the most important effect, since the EU is an important net exporter of dairy products. When a generic 20% increase of compliance to the current best-estimate level is assumed (rather than full compliance) these impacts shrink by 40 percent.

The impact of an improvement of compliance to full compliance with respect to the Identification and Registration standard is projected to lead to a decline of EU dairy exports by 0.1% and an increase in EU dairy imports by 1.1 percent.

When the measures on Nitrate taken by the US, Canada and New Zealand are taken into account and it is assumed that compliance to these measures will improve to full compliance, just like was assumed for the EU, this would slightly reduce the negative impacts on the EU's trade flows. As such this underscores that in general the competitiveness impact analysis made for the EU is sensitive with respect to assumptions made about what happens with respect to standards in key competitor countries. In this specific case the impact of what other countries to improve compliance with their current standards appeared not to have a great impact. Since there were signals that the EU's competitors face pressures to increase rather that to relax there standard-levels, the trade impacts obtained when no changes are assumed to happen in key-competitors countries can thus be argued to provide an upper bound of the likely trade impacts.

The combined impact of the Nitrate and Identification and Registration standards on EU dairy exports and imports is estimated to be -0.87% and +1.01% respectively (given no changes in standards or compliance for other trade partners).

The allowance of bST hormone use affects trade patterns creating currently a relative disadvantage for the EU's dairy export position. A ban on bST hormone use in the US is argued to lead to a 5% percentage costs increase for US farmers, which appears to lead to a potential improvement of EU dairy exports by nearly 2.4 percent. Alternatively, the EU food safety standard prohibiting the use of bST can be stated to have an opportunity cost in terms of forgone trade opportunities.

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REFERENCES

1. Cassells, S. M. and A. D. Meister, 2001. Cost and trade impacts of environmental regulations: effluent control and the New Zealand dairy sector. The Australian Journal of Agricultural and Resource Economics 45 (2), p. 257-274.
2. De Roest, K., C. Montanari, and E. Corradini, 2007. Il costo della Direttiva Nitrati, BIT SpA - Cassa Padana, Leno (Brescia). CRPA.
3. DG-AGRI, 2007. Study to assess the administrtaive burden on farms arising from the CAP. Final report 2006-G4-03, Directorate General for Agriculture and Rural Development.
4. EC, 2006. Milk and milk products in the European Union - August 2006, in DG for Agriculture and Rural Development. Luxemburg: European Comission, p. 27.
5. Hemme, T. (Ed.). 2002, IFCN Dairy Report 2002 - Status and prospects of typical dairy farms worldwide. Braunschweig: Dõring Druck, Druckerei &Verslag GmbH, Germany, p. 141.
6. Jarvis, L. S., 2002. The potential effect of recombinant bovine somatotrophin on world dairying. In *Market development for genetically modified foods*, V. Santaniello and R. E. Evenson and D. Zilberman (Eds.). Wallingford: CABI Publishing, p. 101-111.
7. Jongeneel, R., F. Brouwer, M. Farmer, R. Müssner, K. de Roest, G. F. X. Poux, A. Meister, Z. Karaczun, J. Winsten, and C. V. Ortéga, 2007. Compliance with mandatory standards in agriculture; A comparative approach of the EU vis-à-vis the United States, Canada and New Zealand. Rapport 6.07.21, LEI, Den Haag.
8. Kuik, 2006. Ex ante and ex post costs of implementing the Nitrates Directive. Study for DG Environment, Contract No. ENV.G.!/FRA/2004/0081, Free University, Institute for Environmental Studies, Amsterdam.
9. Le Roux, J., Evan Williams, Andrew Staines, and A. Bergmann, 2008. Environmental Quality and the Cost of Environmental Regulation: a Comparison of Scotland with the International Community. European Environment 18, p. 45-54.
10. MAF, 2005. 2005 Dairy Monitoring Report Ministry of Agriculture and Forestry. (http://www.maf.govt.nz/statistics/primaryindustries/farm-monitoring/dairy.htm accessed: 15 December).
11. Meister, A. D., 2006. Deliverable 5: Mandatory standards in 7 EU countries and 3 non-EU countries. Country Report: New Zealand. Department of Applied and International Economics, Massey University, Massey, p. 52.
12. Tauer, L. W., 2002. The impact of bovine somatotropin of farm profits. In *Market development for genetically modified foods,* V. Santaniello and R. E. Evenson and D. Zilberman (Eds.). Wallingford: CABI Publishing, p. 81-90.
13. Xu, X., 2000. International trade and environmental regulation: time series evidence and cross-sectional test. Environmental and Resource Economics 17, p. 233-257.

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