Economic impact of cross compliance in the field of animal welfare (Acts C18 and C16): assessment of animal welfare in two dairy farms, estimation of costs of improvements in housing and management, simulation of the economic impact of applying for animal welfare payments (measure 215)

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Abstract

The paper reports the results of assessment of animal welfare at farm level on two dairy cattle farms, identification of structural and management actions to improve the animal welfare and estimate of the costs of such actions; furthermore the economic impact of the potential support under measure 215 of the Rural Development Plan was also simulated. At the time of assessment, no severe break of compliance was detected at the two farms; however some weaknesses were identified and improvement were proposed in order to maintain the current animal welfare status and avoid future failures. The two case studies showed that investments to improve animal welfare were partly self-funded in the mid and long term due to the higher milk yield and the better animal health that were expected as consequence; however, in the short term, a large part of expenses was fully borne by farmers if not supported by a public grant or higher market prices. The support provided by the measure 215 is effective in rewarding farmers who undertake to adopt standards of animal husbandry which go beyond the relevant mandatory standards.

Introduction

Animal welfare (AW) is a prerequisite for sustainable agriculture and livestock farming whose standards are prescribed in terms of minimum requirements by European and national laws. In 2003, according to Regulation (EC) No. 1782/2003, AW became one of the statutory management requirements that must be respected by all farmers who receive direct payments; the direct payments have been linked to the adherence of specific cross compliance conditions; two types of conditions to be complied have been defined in terms of minimum standards: Good Agricultural and Environmental Conditions (GAEC) and Statutory Management Requirements (SMRs). Good Agricultural and Environmental Conditions regard soil conservation, minimum maintenance of agricultural land and the preservation of landscape elements. Statutory Management Requirements are obligations already existing (EU Directives and Regulations) in the areas of animal and plant health, environment and animal welfare.

Good agricultural and environmental conditions and statutory management requirements are defined by acts and standards written in the Annexes to the Regulation and its amendments. The Act C18 regards the protection of farm animals, is based on Directive 98/58 /EEC and covers all farms with any type of animal bred or kept for the production of food, wool, fur or other agricultural purposes; furthermore, dairy farms must meet the criteria defined by the Act C16 concerning the Directive 2008/119/EC which establishes the minimum standards for the protection of calves. Moreover, AW is part of a policy of voluntary improvement in rural development programs. In 2005, the Council Regulation (EC) No. 1698/2005 stated AW as a clear objective of rural development policy; since then, the Member States have had the possi-

bility to implement measures which aim at improving animal welfare through EU rural development funding. For the period 2007-2013, measure 215 'Animal Welfare Payments' was included in Rural Development Programmes (RDPs) in the following Member States: Austria, Estonia, Finland, Germany, Hungary, Italy, Slovakia, Spain and UK. In Italy measure 215 was implemented in the following regions: Campania, Emilia Romagna, Liguria, Piedmont, Tuscany, Umbria, Valle d'Aosta and Veneto. To apply for Measure 215, farmers must implement farming techniques that improve animal welfare more than the usual good animal husbandry practices; usual good animal husbandry practices are those which ensure a minimum level of animal welfare based on the minimum cross-compliance of the existing legislation.

The current paper reports results of monitoring the economic impact of cross-compliance in the field of animal welfare carried out as part of MONACO project. The compliance with SMRSs in the field of animal welfare was assessed at two dairy cattle farms owned by CREA-FLC located in Lombardy: in the municipalities of Cremona and Lodi; interventions to be carried out in order to maintain and improve animal welfare at the two farms were identified; costs of such improvements were calculated; the economic impact of the potential support under measure 215 was simulated.

Materials and methods

The monitoring was carried out in two farms belonging to the CREA network: Porcellasco Farm and Baroncina Farm; both are located in Lombardia, in the Po valley were most of the Italian milk is produced and most of dairy cows are farmed.

Porcellasco Farm

Porcellasco Farm (Cremona, Italy) extends for 82 hectares. The soil is of medium texture and very fertile. Main crops are maize and alpha-alpha to be used as silage and hay to feed the cattle; in 2013, 80 lactating cows and 75 young stock were farmed; the average milk yield was 8711 kg/cow.

Baroncina Farm

Baroncina farm (Lodi, Italy) extends for 40 hectares. At the farm are present, on average, 130 Friesian dairy cattle, 70 growing stock and 60 lactating cows that produced 10,703 kg/cow in 2013.

Assessment of animal welfare at farm level

A methodology called IBA, acronym for the Italian words *Indice di Benessere Allevamento* that means Index of Welfare at Herd Level or Farm Welfare Index (FWI) was adopted to assess AW in the two farms described above; FWI is an on-farm index system developed by the CRPA (Research Centre on Animal Production, Reggio Emilia, Italy), in cooperation with the Universities of Bologna and Florence (Barbari *et al*., 2007); FWI is a tool to identify the weaknesses at farm level, allowing the farmers to improve the welfare of their animals; the index value allows to allocate a farm in one out of 6 established classes as described in Table 1.

Farm Welfare Index relies on a limited number of easily measurable parameters. Parameters used for the assessment of bovine farms are based on the existing legislation on the protection of calves (Directive 2008/119/EC) and the general regulations for the protection of animals kept for farming purposes (Directive 98/58/EC transposed by national legislative Decree March 26, 2001, No. 146); the selected parameters have been experimentally studied by researchers and field-tested by taking into account experiences of farmers, veterinarians and technicians.

The assessment procedure consists in the following actions in sequence:

- farm inspection and filling checklists
- input of data collected on a specific software for data storage and evaluation of animal welfare;
- calculation by the software of partials and total scores (FWI); this stage provides the potential classification of the farm (FWIP);
- detection of possible breaches of compliance with standards and the final rating of the farm (R).

The checklists are organised in 6 forms grouped by 3 areas called *general*, *buildings* and *categories*.

General are forms filled in collaboration with the responsible of the farm and collect information concerning the general data on the farm (*e.g.,* animal census), the management of animals, the control of the facilities, the staff (*e.g.,* number of employees, qualification and staff training), the facilities for the calving and isolation, hygiene and health of animals.

Buildings are forms (one for each building) collecting information on barn features, environmental control, level of cleanliness and state of the different areas of the buildings and of the equipment.

Categories are forms (one for each category of animals) collecting information on type of pen, features of pens (passageways, doors and alleys drinking), features of functional areas (rest area, feed area, exercise area) inside the pens, cooling in summer, hygienic-sanitary and behavioural aspects.

The evaluation of breaches of cross compliance is based on failure of compliance with Directive 2008/119/EC (protection of calves); criteria of severity, extent, permanence and repetition were considered to affect the final scoring; this stage provides the actual ranking.

Measure 215: Payments for Animal Welfare

The economic impact of payments for animal welfare in the context of rural development plan (measure 215) on farms Porcellasco and Baroncina was simulated; because this measure is not currently implemented in Lombardy, the simulation was done with reference to the rules applied in a close and similar region, Emilia Romagna; Emilia Romagna is bordering Lombardy and has similar agricultural conditions.

Implementation of measure 215 in Emilia Romagna requires that the appliers assess the starting animal welfare level of their farms; for dairy farms, this preliminary assessment of the animal welfare is implemented by the means of the calculation of the FWI; to apply for measure 215, a farm has to reach at least class 3 *farm with a sufficient level of welfare*; the presence of non-compliance with usual good animal husbandry practices must be resolved within the time and in the manner prescribed by the operational program of the Measure 215 (however, before the first request for payment), otherwise the aid application is not admissible. The payment is based on the number of livestock (Livestock Units, LU) placed under commitment for a period

Table 1. Classification of bovine dairy farms according to farm welfare index.

Class	Description of the level of animal welfare
1	Very poor (it does not comply with the minimum requirements)
2	Low
3	Fair
4	Moderate
5	Good
6	Very good

of 5 years. There is a distinction in payments, according the location (plain or mountain) and the type of production. The maximum level of support for farmers producing milk for drinking or making *Grana Padano* cheese is € 202.58/LU. The maximum payment can be obtained by adding commitments in the following areas, each of which entitles the farmer to a specific portion of payment:

i) management of farm and staff (5%) = € 10.12 / LU (of which € 5.06/LU for each commitment); this area of commitments includes the participation of staff in training courses on animal welfare and the regular checking of automatic systems functioning in the farm. These two commitments are compulsory and must be accompanied by at least another commitment among those included in the following areas;
ii) housing conditions (30%) = € 60.77 / LU;
iii) environmental controls (25%) = € 50.65 / LU;
iv) water and feed (15%) = € 30.39 / LU;
v) hygiene, health and behavioral aspects (25%) = € 50.65 / LU.

Livestock units are calculated as follows:
1cattle above 2 years = 1 LU;
1cattle between 6 months and 2 years = 0.6 LU;
1cattle under 6 months = 0.4 LU.

Other income

The improvement of animal welfare has positive impact on the overall profitability of the farms in the medium to long-term.

It was estimated that the interventions cause an increase in milk production; it was also estimated that the improvements lead to a reduction in production costs, primarily due to lower health care costs as a result of improved health status of the cow; the evaluation of these benefits was made according to scientific and technical literature (Bach *et al*., 2008; Krawczel *et al*., 2008; Nishida *et al*., 2004, Speroni and Federici, 2006)

Profitability of the investments

The economic evaluation of the planned improvements can be done by calculating the net present value (NPV); NPV of a cash flow is defined as the present value of the sum of the future cash flows produced by the investment; it represents the amount of the wealth generated by the intervention, referred to the time zero (*i*.e., at the time of the hypothetical investment). A positive NPV indicates the validity of the intervention, because the future earnings from the investment exceed the amount of the investment and any further cost.

The critical aspect of this procedure is the identification of the discount rate; in the current cases, a rate of 4.5% was adopted for investments with estimated lifetime of 15 years.

Results

On July 10, 2013, two experts from CRPA visited and rated the two farms.

Assessment of animal welfare at Porcellasco Farm

The final rating of Porcellasco farm is reported in Table 2, which shows the total and partial scores.

The following main weaknesses were detected:
- lack of participation of employees in educational/ training courses on AW;
- irregular administration of colostrum to calves within the first 6 hours of life;
- slightly insufficient natural ventilation in the building that houses the lactating cow
- cubicles in the barn for lactating cows not very comfortable for the presence, of old design dividers (two pillars) and old worn synthetic mats;
- poor cleaning of drinkers in the barn for lactating cows;
- worn manger in the barn of lactating cows.

There were no severe breaches of compliance for calves, thus the potential classification was equal to the final one.

The final rank for the Porcellasco farm was "Farm with a good level of animal welfare (CLASS 5)".

Assessment of animal welfare at Baroncina farm

In Table 3 are reported the partial scores and total scores for Baroncina farm. The following main weaknesses were detected:
- lack of participation of employees in training/educational courses on animal welfare;
- flat ceiling in the barn for dairy cows and pregnant heifers; deteriorated surfaces (except floors) in all buildings;
- slight overstocking due to the number of cubicles lower than the number of lactating cows (44 cubicles for 47 cows);
- some cubicles shorter than recommended;
- alley between cubicles narrower than recommended; steps and narrow passages on the way to milking parlour;
- boxes of pre-weaning calves not sheltered from the wind and sun.

There were no breaches of compliance for calves, thus, the potential rank was equal to the real one.

The final evaluation was the following: *Farm with very good level of animal welfare*.

Suggested improvements and their costs

Experts from CRPA suggested interventions based on the issues

Table 2. Scoring and ranking of Porcellasco farm.

Checklist	Score
General	22.0
Buildings	20.2
Categorie 1: lactating cows:	22.6
Categorie 2: dry cows	15.5
Categorie 3: replacement cattle	15.4
Categorie 4: calves	4.2
FWI	99.9
	Class
Potential classification according FWI	5
Classification after checking the compliance with law	5

FWI, farm welfare index.

Table 3. Scoring and ranking of Baroncina farm.

Checklist	Score
General	27.5
Buildings	18.3
Category 1: lactating cows:	33.2
Category 2: dry cows	15.0
Category 3: replacement cattle	12.3
Category 4: calves	9.3
FWI	115.6
	Class
Potential classification according FWI	6
Classification after checking the compliance with law	6

FWI, farm welfare index.

raised by FWI and possible commitments to be considered by Measure 215.

Improvements at Porcellasco farm

The improvements suggested for Porcellasco farm are the following:
- participation of 3 employees in training courses on animal welfare, with the release of a certificate by the institution of training;
- monitoring (with a frequency of up to 4 months) of automatic plants (milking, ventilation and watering), performed with self-test procedure to be carried forward in a special register;
- remake of cubicles in the barn for dairy cows consisting in replacement of the existing dividers with new ones (flag shaped), replacement of the existing old synthetic mattresses with new synthetic two-layers-mattresses; these interventions will improve the cow comfort and space allowance, leading to have 10% more housing space than the minimum specified by the usual good animal husbandry practices (6 m^2 for dairy cows and pregnant heifers) ;
- remake of drinking water system in the barn for dairy cows, with replacement of the existing 10 small drinker cups with 8 new drinker tanks 1 m long;
- increased frequency of cleaning of water troughs;
- remake of approximately 130 m deteriorated manger in the barn for dairy cows;
- regular administration of colostrum to calves within the first 6 hours of life;
- adoption of plans to control flies and rodents.

Table 4 shows the main costs for the improvements planned at Porcellasco farm. In addition, a cost of € 1800/year must be considered due to the increased daily labour for the following commitments: cleaning water troughs, monitoring systems; compiling registers, administrating colostrum consistently within the first 6 hours of life.

Improvements at Baroncina Farm

The improvements suggested for Baroncina Farm are the following:
- participation of employees in the courses of training / education on animal welfare with the release of a special certificate by the institution of training;
- regular monitoring (with a frequency of up to 4 months) in automatic plants on the farm (milking, ventilation and watering), performed with self-test procedure to be recorded in a special register;
- installation of a plant to treat the drinking water from well;
- displacement of the box pre-weaned calves in a place sheltered from the wind and sun;
- adoption of plans for the control of flies and rodents.

Table 5 shows the main costs of improvements at Baroncina farm. For the 1st year only, an estimated cost of € 2000 must be considered for the labour due to the displacement of boxes for calves to an area sheltered from sun and wind.

In addition, increased costs for labour must be considered as follows: maintenance of water purification system of watering, monitoring systems; compiling registers; a cost of € 1000 /year was estimated for this extra-work.

Payments for animal welfare (Measure 215)

Porcellasco farm

Table 6 reports the potential payments under Measure 215 for Porcellasco farm. The calculation of total payments at the end of the five years took into account that the premium on the 2nd, 3rd, 4th and 5th year are respectively at 80%, 60%, 40% and 20% of the premium obtained in the first year of investment.

Baroncina farm

Table 7 shows the potential payments under measure 215 for Baroncina farm; methods of calculation and general considerations above reported for Porcellasco Farm are still valid.

Other incomes

Porcellasco Farm

The following costs were taken into account to calculate NPV:
- training course, the cost was fully charged at the beginning of period (1st year), for a total of € 1020;
- costs for improving buildings and equipment, the cost (€ 47,912) was fully charged at year 0, *i.e.,* the reference year for the calculation of NPV ;
- ecurring annual costs for contracts to control, flies and rodents, for a total of € 2600/year;
- recurring annual costs for increased daily labour (cleaning troughs, monitoring of equipment and records compilation, timely administration of colostrum), for an estimated amount of € 1800/year.

The income consisted in:
- payments for animal welfare (Measure 215) from 1st to 5th calculated as in Table 6.

Table 4. Costs for interventions to be carried out at Porcellasco farm.

Improvement	Cost (€)	Quantity	Total cost (€)
Training course on animal welfare	340.00	3	1020
New dividers (flag shaped) between cubicles	105.00	136	14,280
New mattresses for cubicles	167.00	136	22,712
New drinkers	390.00	8	3120
Remake of manger	60.00	130 m	7800
Plan against flies and rodents	2600.00	1	2600

Table 5. Costs for interventions to be carried out at Baroncina farm.

Improvement	Cost (€)	Quantity	Total cost (€)
Training course on animal welfare	340.00	2	2680.00
Plant for treatment of water from the well	900.00	1	9800.00
Plan against flies and rodents	2000.00	1	2600.00

- greater milk production system estimated at 2.4% per year from the 6th year onwards, compared to the production before the investment (690,000 kg). For the first 5 years, the increase was considered as progressive, 0.4%, 0.8%, 1.2%, 1.6% and 2% respectively. Considering a sale price of milk of € 0.44 / kg, higher revenues resulted as follows: € 1214 (1st year), € 1822 (2nd year), € 3643 (3rd year), € 4858 (4th year), € 6072 (5th year) and € 7286 (6th year onwards);
- lower costs for veterinary interventions, purchase of medicines and greater longevity of the cows, estimated at € 1,500 from the 6th year. For the first 5 years the reductions of annual costs were estimated as follows: € 250 (1st year), € 500 (2nd year), € 750 (3rd year), € 1,000 (4th year) and € 1250 (5th year).

The calculation procedure returned a positive NPV of € 21,710.

Baroncina farm

The following costs were considered:

- training course, the cost must be fully charged at the beginning of period (1st year), for a total of € 680; the same amount will be spent in the 6th and 11th year to update the training;
- plant for treatment of water from the well, the cost of € 9800 must be charged attributable to year 0, that is, the reference for the calculation of NPV;
- recurring annual costs of € 2600/year for plan against flies and rodents;
- recurring annual costs greater daily labour for an estimated amount of € 1500/year;
- movement of individual boxes for calves in a position different from the current one; the cost of € 2000 must be charged on the 1st year.

The income consisted in:

- payments for animal welfare calculated as in table;
- greater milk production as effect of improved comfort; it was considered that 6 years after the investment the milk production should be 2% more than the production before investment (631,000 kg). For 1st to 5th year, the increase was considered to be progressive: 0.5%, 0.8%, 1.1%, 1.4% and 1.7%, respectively. Considering a sale price of € 0.41 / kg, higher revenues were estimated as follows: € 1294 (1st year), € 2070 (2nd year), € 2846 (3rd year), € 3622 (4th year), € 4398 (5th year) and € 5174 (6th year onwards);
- lower costs for clinical and subclinical mastitis and other diseases, valued at € 500 per year from the 6th year. For the first 5 years the reductions of costs are estimated as follows: € 250 (1st year), € 300 (2nd year), € 350 (3rd year), € 400 (4th year) and € 450 (5th year).

The procedure returned a positive NPV, amounting to € 23,048.

Discussion

At the time of assessment, no severe break of compliance was detected at the two farm monitored; however weaknesses were identified and improvement were proposed in order to maintain the current animal welfare status and avoid future failures.

The two use cases showed that investments to improve animal welfare were partly self-funded in the mid and long term through higher production and higher animal health, which lowers costs of production; however, in the short term a large part of expenses remained fully borne by farmers if not supported by a public grant or higher market prices. Improving AW is beneficial to society as a whole, thus the costs due to improving animal welfare should be shared between different parties of a community (farmers, consumers, institutions).

The financial support set up under the European Agricultural Fund for Rural Development as measure 215 is an effective way to do this. Hopefully, in the future, higher market prices will compensate costs for improving animal welfare; however, to achieve this, voluntary schemes promoting high standards of animal welfare must be set by farmer, industry or seller; voluntary schemes should be effective in creating a consumer transparent and reliable confidence.

Table 6. Potential payments under measure 215 for Porcellasco Farm.

Commitment	LU (n)	Payment (€ /UBA)	1st year (€)	2nd year (€)	3rd year (€)	4th year (€)	5th year (€)	Total (€)
Management and personnel (training course and monitoring automatic plants)	111	10.12	1123.32	898.66	673.992	449.33	224.66	3369.96
Housing conditions (new dividers and mattresses)	82	60.77	4983.14	3986.51	2989.88	1993.26	996.63	14,949.42
Water and feeds (new drinkers)	82	30.39	2491.98	1993.58	1495.19	996.79	498.40	7475.94
Water and feeds (manger remake)	82	30.39	2491.98	1993.58	1495.19	996.79	498.40	7475.94
Hygiene (flies and rodents)	111	50.65	5622.15	4497.72	3373.29	2248.86	1124.43	16,866.45
Total			16,712.57	13,370.06	6685.03	3342.51	3342.51	50,137.71

Table 7. Potential payments under measure 215 for Baroncina farm.

Commitment	LU (n)	Payment (€ /UBA)	1st year (€)	2nd year (€)	3rd year (€)	4th year (€)	5th year (€)	Total (€)
Management and personnel (training course and monitoring automatic plants)	124	10.12	1254.88	1003.90	752.928	501.95	250.98	3764.64
Water and feeds (well water treatment)	124	30.39	3768.36	3014.69	2261.02	1507.34	753.672	11,305.08
Hygiene (flies and rodents)	124	50.65	6280.60	5024.48	3768.36	2512.24	1256.12	18,841.80
Total			11,303.84	9043.07	6782.30	4521.54	2260.77	33,911.52

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