Revision of economic values for traits within the economic breeding index

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Background

The economic breeding index (EBI) was launched in November 2000 as the selection tool for the realization of the Irish dairy breeding objective. It is derived from the breeding values for three milk production traits namely milk yield, fat yield, protein yield, as well as two functional traits measuring cow fertility (calving interval) and longevity in the herd (survival) each weighted by their respective economic values. The economic values applied in 2001 were derived using the 'Moorepark Dairy Systems Model' (Shalloo et al., 2004) using costs and prices that were current at the time. Since then, there has been significant changes in national and International economic policies affecting dairying. The impact of these changes on costs and prices along with inflation has necessitated a review of the of the economic values used as weights for the various index traits. Regular revision of the economic values is also a norm to avoid the danger of an outdated selection tool.

Objectives

The specific objectives of the current review were;

- To re-calculate the cost of replacement heifers based on actual costs of rearing an in-calf heifer to 23 months of age
- To revise the milk payment scheme by updating milk price, fat:protein price ratio, levies, and cost of transport, cooling and processing of milk carrier and finally,
- To determine the impact of the above and hence revise the economic values of the five traits included in the EBI taking into account current costs and future projected prices with full implementation of the Fischler proposals.

Materials and Methods.

Replacement heifer costs

Previously the "Moorepark Dairy Systems Model" used to calculate the economic weights for the traits in the EBI, included a replacement heifer value of €1,397 as the market value of in-calf heifers in 2000. This value was revised to take into account the current actual cost of rearing an in-calf heifer to 23 months of age. It was assumed that each replacement heifer would require 1.1 acres of land from birth to 23 months. The opportunity cost of land was taken as €108/acre. The Veterinary, insemination and medication costs were computed covering the period from 1 month to 23 months of age with the assumption of 1.7 services per heifer. The cost of labour was based on a requirement of 15 hours of labour per heifer over the 23 months at a cost of €12.44/hour. It was assumed that 10% of heifers would not go in calf and would be subsequently slaughtered bringing in €403/head. All other updated costs and prices were taken from Teagasc, (2002).

Milk payment scheme

Milk price is expected to drop from 27.8 cents/kg to 21.7 cents/kg under the Fischler proposals (FAPRI, 2003). The current Fat to Protein price ratio, levies, as well as the cost of

transportation, cooling and processing were obtained based on the counsel of researchers and members of the dairy industry after a series of extensive consultations.

Revision of economic values
The revised costs and prices were used to update the old values in the 'Moorepark Dairy Systems Model'. These new values were based on up to date replacement costs; future predicted milk price, future predicted fat:protein price ratio, updated levies, the costs of transportation, cooling and processing as well as future cull cow and calf prices. The Food and Agricultural Policy Research Institute Ireland partnership (FAPRI-Ireland) has predicted a male calf value of €102 and a cull cow value of €270; the previous male calf and cull cow value were €190 and €381 (FAPRI, 2003). Quota purchasing cost was reduced from 9.8 cents/litre to 4.80cents/litre. Quota purchase price was assumed to be €1/gallon and the money was assumed borrowed over 5 years at 4% interest. The estimated cost included the interest and capital repayments. Economic values were derived for three different quota scenarios as follows: The first scenario (S1) represents a situation where there is a quota for milk and fat%. The number of cows per farm is fixed but purchase of quota is possible. The second scenario (S2) represents the situation were there was no quota on milk and fat percentage but the number of cows per farm was fixed. The final scenario (S3) represents the situation where there was quota for milk and fat % and the output per farm was also fixed.
Economic values for each trait under each scenario were derived for comparison.

Sensitivity analyses
A sensitivity analysis was performed to determine the robustness of the economic weights while varying replacement costs, milk price, quota purchasing price and the fat to protein price ratio.

Results and Discussion

Cost of replacement heifer

The costs associated with rearing a replacement heifer, following full implementation of the Fischler proposals, is summarised in Table 1. The cost of a replacement heifer was €88 less than that previously included in the bio-economic model; the difference arose from reductions in both the cost of concentrates and the opportunity cost of land.

Milk payment scheme

Table 2 shows the old and new milk price, fat:protein price ratio, the different levies and the cost of transport, cooling and processing (€/kg milk carrier) in the model used to derive the economic weights. Following full implementation of the Fischler proposals milk price is expected to fall to 21.7 cents/kg (FAPRI, 2003). The expectation is that with time the fat to protein ratio will get closer to 1:2 (Randles, Irish Dairy Board, p*ersonal communication*). This was correctly projected in the old bio-economic model; therefore there was no need to alter the fat:protein price ratio in the revised model. The table also show that the levies applied to milk have changed in the intervening period. At the end of December 2003 the Bovine disease levy was 0.22 cents/kg; however this is projected to fall by 25% in 2004 (Lascurettes, Irish Farmers Organisation, p*ersonal communication).* The voluntary IFA/macra and ICMSA

levies were previously both included in the model at 0.15% of milk value. Only one of these levies is currently included at an average rate of 0.033 cents/kg.

The main components of the transportation cost were the costs of fuel (diesel), labour and insurance. On average the cost of road transport increased by 17% from 2000 to 2003 (Brew, CSO, *personal communication)*. Therefore the cost of transport included in the bio-economic model increased from €0.0107 to €0.015/kg milk. Energy cost is the main factor associated with the cost of cooling; electricity charges increased by 21% from 2000 to 2003. However, this was countered by an increase of about 20% in the the efficiency of cooling a unit of milk in the same period. There was thus no change in the cost of cooling in the bio-economic model. A number of different factors are associated with the cost of processing. Communication with Irish processors revealed that the cost of processing is generally expected to increase to about €0.04/kg in the future

Table 1. Costs associated with rearing replacement animals with Fischler prices

	Cost (€)
Variable Costs	
Concentrates	104.8
Fertilizer, Lime and Reseeding	128.6
Land Rental	118.4
Machinery Hire	9.5
Silage Making	90.4
Vet, AI and Medicine	128.5
Total Variable Costs	580.2
Fixed Costs	
Car use, water and electricity	20
Labour	221.7
Machinery operation and Repair	8.1
Phone	10
Insurance, A/Cs, T'Port, Sundries	39.6
Interest repayments- term loan	66.7
Total Fixed Costs	**366.1**
Depreciation	
Buildings	58.8
Machinery	20
Total Costs	**1025.1**
Initial value of the calf	330
Sales of heifers failing to Conceive	-36.1
Net Cost of rearing a replacement heifer (€)	**1319**

Table 2. Milk payment scheme (€/kg milk carrier) included in the previous EBI (2000) and the current EBI (2003).

	2000		2003	
	Fat	Protein	Fat	Protein
Reference milk	3.60%	3.30%	3.60%	3.30%
Gross price kg milk	27.8		21.7	
Price ratio	1	2	1	2
Gross price per kg solids	298	597	240	481
- VAT REFUND RATE (%MONTH)	305	611	251	501
Deduction per kg carrier				
EU Levy	0.448			
Irish Dairy Board Levy (formerly Bord Bainne Levy)	0.170		0.143	
Teagasc levy	0.025		0.062	
Bovine Disease Levy	0.380		0.170	
Dairy Inspection Levy (formerly Dept. Agric Inspection)	0.074		0.103	
IFA/ICMSA/Macra fund	0.025		0.033	
National Dairy Council Levy			0.071	
TOTAL LEVIES	**1.123**		**0.582**	
Cost of Transport	1.07		1.50	
Cost of Cooling	0.25		0.25	
Cost of Processing	1.63		4.00	
TOTAL DEDUCTIONS (cents/kg)	4.069		6.332	

Effect on economic values

The net effect of all changes in the Moorepark model on the economic values is illustrated in Table 3. In the S1 scenario there was no change in the economic value for milk carrier, one kg increase in milk yield (keeping all other traits in the EBI constant) reduced profit per lactation by €0.08. This cost was associated with the cost of transportation, cooling and processing of milk carrier (i.e. milk less the fat and protein). The economic value for fat yield in the S1 scenario increased; despite the reduction in the price per kg fat with implementation of the Fischler proposals. This was because the cost of purchasing quota reduced by relatively more than the reduction in cost of fat meaning that more income can be earned from increased quantity of fat sale. This results in an increase in margin from fat hence the increase in the economic value. The expected decrease in price per kg protein in the future is the main reason for the reduction in the economic value for protein yield. The economic value for survival decreased. A decrease in survival of 0.1% increased returns per cow by €0.57 while income from livestock sales decreased by €0.36 plus higher quota leasing, labour, land and concentrate costs. However, there was a saving on livestock purchases of €1.83 per cow. The economic value for calving interval is likely to increase in future years. The increased importance of calving interval is due to the expected higher future costs of production and the inclusion of revised lactation curves that were more representative of the national dairy herd. In the old model, the economic value of calving interval was made up of +€6.60 for increased milk sales, -€0.74 for reduced livestock sales and -€7.94 for increased total costs which sum up to -€2.07. In the revised model, the respective figures are -€0.65, +€0.20, and -€6.64, for milk sales, increased livestock sales, and increased total costs, respectively; the sum of the three parameters is -€7.09. Similar explanation can be given for the changes in economic values across the alternative quota scenarios.

The relative emphasis on the traits included in the EBI across the different quota scenarios following the revision of the costs and prices are shown in Table 4. The change in relative

emphasis is greatest in calving interval (i.e., changed from a relative emphasis of 8% in the S1 scenario of the old EBI to 22% in the S1 scenario of the revised EBI).

Table 3. The effect of the revision of the bio-economic model on the economic weights of the traits in the EBI under the three different quota scenarios.

	Old EBI			Revised EBI		
Traits in the EBI	**S1 (€)**	**S2 (€)**	**S3 (€)**	**S1 (€)**	**S2 (€)**	**S3 (€)**
Milk	-0.08	-0.05	-0.10	-0.08	-0.06	-0.08
Fat	0.86	2.54	-0.42	1.50	2.35	1.61
Protein	5.70	5.70	5.70	5.22	5.22	5.22
Survival	11.40	13.30	9.98	10.77	11.74	10.91
Calving interval	-2.07	-1.08	-2.81	-7.09	-7.24	-7.12

Table 4. Relative emphasis on the traits within the EBI with both the updated costs and Fischler prices for quota scenario one.

	Old EBI			New EBI		
Traits in the EBI	**S1 (€)**	**S2 (€)**	**S3 (€)**	**S1 (€)**	**S2 (€)**	**S3 (€)**
Milk	20%	11%	25%	17%	13%	16%
Fat	8%	22%	4%	12%	17%	12%
Protein	42%	38%	41%	32%	30%	32%
Survival	23%	25%	20%	18%	19%	18%
Calving interval	8%	4%	10%	22%	21%	22%

Sensitivity analysis

Altering the price of replacements affected only the economic value for survival; decreasing the cost of the replacement by €200 reduced the economic value for survival from €10.77/percent to €8.74/percent. Altering the milk price in the bio-economic model affected the economic value for fat yield, protein yield and survival. Reducing the milk price from 21.7cents/kg to 18cents/kg reduced the economic value for fat yield, protein yield, and survival to 1.50/kg, €5.22/kg and €10.77/percent survival, respectively. Altering the fat to protein ratio affected the economic value for fat yield and protein yield. Changing the fat to protein price ratio from 1:2 to 1:4 (closer to world market price ratio) reduced the economic value for fat yield to €1.29/kg and increased the economic value of protein yield to €6.38/kg. The ratio of the economic values for fat yield and protein yield was 1:5; the difference between the two ratios of 1:4 and 1:5 is a function of the higher cost of producing 1kg fat compared to producing 1kg protein. Altering the quota purchasing costs only affected fat yield with a small effect on the economic value for survival. The decrease in quota purchasing costs reduced the negative effect of increasing fat yield. If the cost of quota reduced from €1/gallon to €0.85/gallon then the economic value for fat yield would increase to €1.63/kg. The other extreme is if quotas were freely available and this scenario is highlighted in Table 3 (S2).

References

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