

Development of a dairy processing sector model for the Irish dairy industry

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Introduction Reductions in the Common Agricultural Policy market support, as a result of its continued reform, will expose the Irish and EU dairy industry to increased downward price pressure and increased price fluctuation in the coming years. As a result there will be an increased requirement to reduce costs while at the same time focusing on product portfolio changes to increase revenues in Ireland, which exports 85% of its dairy products and so will be particularly exposed to the fluctuations of the world market in the future. The objective of this paper is to describe a milk processing sector model that simulates the production of dairy products in Ireland. The model was demonstrated by analysing the effect of cow breed and product portfolio change on overall return or net milk value and the individual milk component values.

Material and methods A processing sector model was developed which simulates the manufacture of dairy products. This is a mass balance model accounting for all inputs, outputs and losses. Model inputs including volume of milk intake, its composition, product portfolio and its composition are recorded and utilised in the dairy product simulations. The products produced in the model include cheese, butter, whole milk powder (WMP), skim milk powder (SMP), fluid milk and casein. Within each of the simulations milk is separated to cream and skim milk based on the final product requirements. The skim milk and cream are mixed together in order to develop the required final product specifications, excess cream or skim milk from the process are used in other product manufacture. The quantities of products and by-products that can be produced from the milk pool are calculated and multiplied by the product market values to estimate the market value of the portfolio. In this analysis the assumed values per tonne of product sold are: cheese €4,124, WMP €2,939, SMP €2,406, cream €2,150 and whey €570 (FAPRI). Milk collection, assembly, processing, distribution and marketing costs are applied to estimate all production related costs. The component values of protein (P) and fat (F) are calculated and the net value or return from raw milk is estimated. The net value and component values of milk vary as the composition of milk intake varies. To demonstrate this effect the component values of milk from three cow breeds are compared, each with varying F and P compositions: average Holstein Friesian (HF) (38.3 g/kg F, 33.4 g/kg P; CSO), Jersey (53.3 g/kg F, 40.6 g/kg P; Prendiville *et al.*) and New Zealand (NZ) (43.9 g/kg F, 36.5 g/kg P; McCarthy *et al.* 2006). Two scenarios were analysed to determine the effect portfolio has on overall returns. Scenario 1: 60% cheese, 30% WMP, 10% SMP; Scenario 2: 10% cheese, 30% WMP, 60% SMP. The marginal rate of technical substitution (Coggins and Hammond 1994) was used to calculate the value per kg of F and P whereby for each additional kg of F or P the overall milk revenue will increase depending on the product portfolio, product values and processing costs.

Results In scenario 1 1,000 L of HF, Jersey and NZ milk results in 63.3 kg, 76.0 kg and 68.9 kg cheese, 34.8 kg, 38.3 kg and 35.8 kg WMP and 8.9 kg, 8.9 kg and 8.8 kg SMP being produced respectively. In scenario 1, Jersey milk returns the highest net milk value at €426 while HF milk has the lowest value at €338, reflecting the relative low fat and protein content of HF. In scenario 2 HF, Jersey and NZ milk results in 10.5 kg, 12.7 kg and 11.5 kg cheese, 34.8 kg, 38.3 kg and 35.8 kg WMP and 53.1 kg, 53.3 kg and 52.5 kg SMP being produced respectively. In scenario 2, Jersey milk again returns the highest net milk value at €352 while HF milk has the lowest value at €286. Protein is valued higher than fat in both scenarios with the relative value remaining the same across breed and scenario.

Table 1 Estimated net value of milk and component milk values for Scenarios 1 and 2

Cow breed	Scenario 1			Scenario 2		
	Net Value (€)	F (€/kg)	P (€/kg)	Net Value (€)	F (€/kg)	P (€/kg)
HF	338.46	4.76	7.23	285.99	3.99	6.07
Jersey	426.39	4.44	6.75	352.27	3.67	5.56
NZ	373.08	4.61	7.00	309.07	3.80	5.70

Conclusions The sustainability of the Irish dairy industry has been challenged with the low milk price seen in 2009 coupled with high feed, fertilizer and overhead costs. Change within the industry is essential as has been highlighted by the Prospectus reports⁶. The development and use of a processing sector model, would be a powerful decision support tool for the decision making process within the dairy industry.

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