Ireland's dairy processing sector: Seasonality, profitability and product mix.

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***Abstract* - Ireland's dairy industry is characterized by pastoral spring-calving systems and seasonal milk production at national level. This production seasonality initiates various implications at processor level, such as poor plant capacity utilization off-peak season, seasonal labour management or reliance on dairy commodities. An optimisation model was developed to analyse the impact of production seasonality and quota removal on the Irish dairy processing industry regarding processor gross surplus, product mix and marginal producer milk price (MPMP). Five scenarios with differing milk intake curves were examined whereby a flatter intake curve incurred less variation in the MPMP, capacity utilization and product mix as well as a higher surplus as compared to more seasonal patterns. However, an isolated consideration of financial indicators at processor level disregards key characteristics of Irish grass-based milk production and producer-processor interdependencies; hence a broader modelling approach integrating both the producer and processor perspectives is desirable.**

INTRODUCTION

A compact spring-calving pattern and the maximisation of grazed grass as a feed source enable Irish milk production system to minimise cost per kg of milk produced. On the national level, this means that milk output is highly seasonal with an EU-wide unique peak-to-trough ratio of 4.9:1 in 2009 (Eurostat). Implications for processors include poor off-peak capacity utilisation, reliance on dairy commodities and exports of commodities to world markets (Downey and Doyle, 2007). There is currently substantial debate about the future direction of the Irish dairy processing sector in the context of milk quota removal as well as the strategic positioning regarding seasonality and national product mix (DAFF, 2010). It is anticipated that national milk supply may expand considerably necessitating substantial adaptation by the processing industry. These adaptations are likely to include investment in new plant, industry consolidation and measures to reduce seasonality (Teagasc, 2009).

The overall objective of this paper is to present an economic model for estimating the impacts of seasonality changes on the individual processor. Topics of particular interest include processor profitability, the monthly distribution of milk purchased, processing capacity and product mix.

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METHODOLOGY, DATA AND SCENARIOS

Methodology: The optimisation model used was formulated as a single-criterion, multi-period linear programming problem which identifies (a) the maximum annual processor gross surplus, (b) a corresponding optimum production plan and (c) the marginal values of the milk components fat (FAT), protein (PRO) and lactose (LAC) at monthly intervals for a full year. Processor gross surplus was specified as product gross margin from the entire production plan, less variable costs of collecting and processing raw milk, and less general overhead costs. The marginal milk solids values allow for calculating the MPMP. The surplus-maximizing product mix is subject to a set of technical constraints addressing milk solids levels, input and output volume. Eight product options were available: liquid milk, butter, cheddar, casein, whole milk powder (WMP), skimmed milk powder (SMP), whey powder (WheyP) and lactose.

Data: Input data included milk pool available for processing (tonnes p.m.), milk solids available from milk pool (kg solids/tonne of raw milk p.m.), milk solids required by product (kg solids/tonne of product), processing capacities (tonnes p.m.), costs of collecting and handling raw milk (€/tonne), product price (€/tonne), variable processing costs (€/tonne) and fixed costs (€). Published data (e.g. CSO; Eurostat) was updated for inflation and productivity increases and calibrated to fit the scenarios. Processing cost data estimates (based on Breen, 2001) were validated by dairy co-operative production managers and management accountants.

Scenarios: Five scenarios with different milk supply profiles were run from the perspective of a single milk processing business during and post milk quota regime (Fig. 1). The NoQuota situations (NoQ-Invest, NoQ-Smooth) operated a 25% higher milk intake than the quota-constrained scenarios (Baseline, Smooth, Seasonal; 274,644 tonnes). Except for NoQ-Invest, in which extra dryer capacity and fixed cost from the investment project were assumed, all scenarios had the same processing capacities.

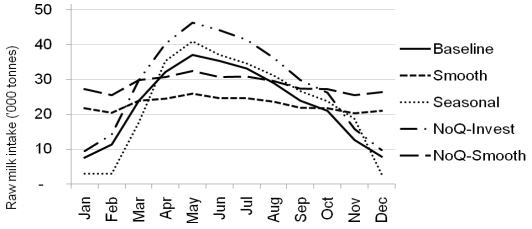

Figure 1. Monthly distribution of raw milk intake.

RESULTS

In the quota-constrained scenarios, Smooth showed the highest surplus followed by Baseline and Seasonal, respectively. Analogously, NoQ-Smooth performed better than NoQ-Invest. This suggests that a lower degree of seasonality is desirable from the processor's perspective (Table 1).

A higher degree of seasonality entailed a higher volume of milk powder (WMP and SMP) in the product mix (Table 1). This is explained by the fact that during peak intake, the processing capacities for the higher-value products (liquid milk, casein, cheddar) were fully exploited and excess raw milk had to be manufactured into the less profitable options (milk powder). The smooth scenarios focused on the more profitable options: The year-round relatively stable milk volume was used up in the manufacture of higher-value output and there was no need to channel resources into milk powder production.

Table 1. Annual financial results and product mix.

	Baseline	Smooth	Seasonal	NoQ-Invest	NoQ-Smooth
Surplus (mill €)[a]	70.65	71.81	69.89	69.80	71.98
MPMP (€c/kg)[b]	23.06	23.21	22.49	17.19	18.18
Output (tonnes)					
Liquid milk	33,972	33,972	33,972	33,972	33,972
Butter	6,076	7,053	5,495	7,712	7,340
Cheddar	11,184	10,418	12,318	13,958	17,303
Casein	3,729	4,284	3,222	3,955	4,284
WMP	1,179		1,289	2,232	411
SMP	133		576	2,563	
WheyP	11,271	11,811	10,980	12,935	15,032
Lactose	1,853	1,892	1,828	2,081	2,393

[a]Product prices applied to the NoQuota situations were 15% lower than those in the quota-constrained scenarios.
[b]Marginal producer milk price is annual weighted average.

Raw milk is more valuable to the processor when it is used in products which achieve higher revenue. As a result, milk solids values, and hence the MPMP, dropped in those months in which milk had to be manufactured into the less profitable goods. Contrary to the smooth scenarios, the seasonal cases entailed notable MPMP fluctuations with a higher MPMP in the trough period and a lower MPMP during peak season (Fig. 2).

Figure 2. Marginal producer milk price by month.

DISCUSSION

Interpretation of results: A more even distribution of the milk intake resulted in a higher processor gross surplus. However, the financial advantage of the smoother over the seasonal situations was only modest and could easily be dissipated by extra costs at producer level (e.g. higher actual producer milk price required to cover extra feed costs incurred by year-round dairying).

Moreover, whether switching from a seasonal to a smooth profile is advantageous from the processor's viewpoint also depends on the structure in place. At present, Irish processors avail of capacity capable of covering production peaks in the summer months. The expense for this equipment has already been made, and switching to a smooth pattern while processing the same annual milk volume would not result in fixed cost savings.

However, since capacities off-peak season are underutilised, there is scope to substantially increase annual throughput without additional investment. The results suggest that in the transition from a quota-constrained to a liberalised market, processors could benefit from evening out the milk intake pattern.

Caveats and future research: The model does not capture externalities (e.g. market failure) or important operational costs of seasonality (i.e. transport, storage or labour). The model focuses solely on economic aspects of seasonality whereas including a social (employment levels) and an environmental component would enrich the study's significance. Nevertheless, the model allows for experimenting with various milk intake patterns, raw milk volumes and policy restrictions to estimate possible effects on processor profitability and product mix. In the next modelling stage, the processor model will be refined to incorporate the operational costs of seasonality. To provide a tool for a holistic sector-wide analysis, a producer model will be developed and both the producer and the processor models will be integrated into an industry-level model.

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REFERENCES

Breen, J. (2001). *A new direction for the payment of milk: Technological and seasonality considerations in multiple component milk pricing of milk (…) for a diversifying dairy industry*. M.Agr.Sci. Department of Agricultural Extension, Agribusiness and Rural Development. University College Dublin, Ireland.

CSO. Databases: *Main Data Dissemination Service*. http://cso.ie/px/pxeirestat/statire/SelectTable/Omrade0.asp?PLanguage=0. [24.11.2010]

DAFF (2010). *Food harvest 2020. A vision for Irish agro-food and fisheries.* Dublin, Ireland: DAFF.

Downey, L. and Doyle, P. (2007). *Cow nutrition and dairy product manufacture – Implications of seasonal pasture-based milk production systems*. Australian Journal of Dairy Technology, 62, 3-11.

Eurostat. *Statistics: Agriculture – Database*. http://epp.eurostat.ec.europa.eu/portal/page/portal/eurostat/home/. [24.11.2010]

Teagasc (2009). *The Irish dairy industry: Challenges and opportunities.* In: TResearch 2009. C. Boyle, P. Dillon, and C. O'Donoghue (eds.). Fermoy: Teagasc.