

The Impact of Imports of Butteroil/Sugar Blends on the Canadian Dairy Industry - An Economic Analysis using the FARM Model

Prepared for the Canadian International Trade Tribunal (CITT) by

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March 1998

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Summary

Imports of a 49% butteroil / 51% sugar blend have been entering Canada at a low tariff rate, primarily for use in the processing of ice cream. The Governor in Council directed the Canadian International Trade Tribunal (CITT) to undertake an inquiry into the importation of dairy product blends which were outside the coverage of Canada's tariff rate quotas. As part of its inquiry, the CITT requested that Agriculture and Agri-Food Canada (AAFC) provide quantitative economic analysis of several specific scenarios². This paper describes the main findings of this analysis.

The analysis has been undertaken with the use of the FARM dairy model, and is based on a number of simplifying assumptions³. This model describes in economic terms the functioning of the Canadian dairy market in the context of its policy instruments. The results provided should be viewed as indicative of the effects of the alternative scenarios described, and not precisely in a predictive sense. The results are conditional on the assumptions used. Scenarios have been analyzed over the future period 1998 to 2002, relative to a base case which is consistent with AAFC's medium term policy baseline. An important feature of this baseline is that it assumes a no-change policy setting.

Throughout the analysis, imports of the butteroil blend are used only for the production of ice cream. In the model used, policy determined prices affect market demand for products and hence quota levels. Butteroil blend imports for ice cream reduce the requirements for domestic butterfat, and the price of ice cream. This reduction in requirements is compensated to a small extent by an increased consumption of ice cream due to its lower price. The results are consistent with other analyses concerning the magnitude of the effect on milk production and producer revenue⁴. The results of this analysis highlight several other important elements:

- The results depend on the maximum market penetration of the import blend. This level of penetration is uncertain.

¹ Principal researcher, Rebecca Ewing, Economist, Economic and Policy Analysis Directorate (EPAD), Agriculture and Agri-Food Canada.

² Letter from R.W. Erdmann of Research Branch at the CITT to Douglas Hedley of Policy Branch at AAFC, dated February 12, 1998.

³ These assumptions are fully delineated in the main text.

⁴ Correspondence from Dairy Farmers of Canada, September 1997.

- ↳ How MSQ is established is critical to the results. The baseline includes a ‘crossover’ point after which MSQ is set on a solids **non-fat** basis, instead of butterfat.
- ↳ The mix of sales among milk price classes under different scenarios affects average producer price.
- ↳ The scenarios affect levels of surplus SMP or butter, and disposal costs are important.
- ↳ Producer revenue estimates do not give full impacts on producers. The average incremental costs of production are an important consideration.

The baseline assumes imports provide 40% of butterfat requirements for ice cream by the year 2000. The average farm milk price increases according to trend. Total milk production is steady to declining, as determined by MSQ and fluid milk production levels set according to changes in domestic consumption. The baseline projects a ‘crossover’ point where requirements of whole milk on a solids not-fat basis become greater than those on a butterfat basis. This situation is reached in the year 2000, after which it is assumed that MSQ is set on a solids not-fat basis. After the crossover, the butter blend imports have little effect on MSQ, and hence there is less effect on milk producers.

The effects of different sets of assumptions (scenarios) on producers, consumers and processors of milk and milk products are evaluated relative to the baseline. Table 1 presents the effects of the scenarios on milk production and farmer and processor revenues. Table 2 presents effects on consumer and producer welfare⁵.

In the first scenario, butter blend imports are eliminated beginning in dairy year 1998-99 (scenario 1a). MSQ is increased accordingly to meet the higher butterfat requirements (until the base cross-over point in year 2000). When blend imports reach the maximum level in the year 2000, total milk production is 2.4 mil hl greater than in the base. The solids non-fat component of this higher MSQ milk production is exported as skim milk powder at world prices. Total producer revenue from sales of milk increases \$84 million from the base in 2000. Higher milk costs for ice cream processors impact on wholesale and retail ice cream prices. Consumers face a higher price for ice cream and consume less. Processors produce less ice cream and more skim milk powder. Ice cream processor revenue over milk costs declines \$10 million in 2000 while butter/powder processor margin increases \$21 million. Consumer expenditure on ice cream rises \$9 million.

On a net-income basis, if the production costs are evaluated at \$32/hl, the producer impact is a gain of about \$7 million in 1998-99, increasing to \$17 million over the medium term. Consumer surplus is \$18 million lower in 1998-99 and \$26 million lower in later years. Under the assumptions of the model, the overall effect on producers and consumers is estimated to be negative, with the decline in consumer surplus exceeding the gain in producer net incomes by \$11 million in 1998, but decreasing to \$8 million by 2002.

⁵ Welfare is a more comprehensive measure of the impact on consumers and producers than expenditure and revenue. For consumers it accounts for the change in price over all consumption, rather than just the change in expenditure. For producers it accounts for the cost of production associated with any change in production level. See section A2 for a discussion of the welfare calculations.

In a special case of the first scenario (scenario 1b), imports are frozen at 1997-98 levels, through a trade instrument such as a tariff rate quota. This case has similar but smaller effects on production, revenue and producer gains and consumer losses.

In the second scenario, a special milk class is created for domestic milk ingredients for ice cream that competes with and eliminates butter blend imports (scenario 2a). Milk costs to ice cream processors are lower than the baseline because all of the butterfat and the solids non-fat are now purchased at a lower cost. As with scenario 1, total milk production increases to compensate for the drop in imports and the increase is greater (3.1 mil hl in 2000) since ice cream consumption is stimulated. However, producers receive the lower special class price for all ice cream milk ingredients meaning the effect on their revenue is lower than in scenario 1, and may be negative. In particular, if the special class is priced at international butterfat and solids non-fat prices (assumed to be \$2.75/kg and \$2.79/kg for 1998/99), then producer revenues fall in this scenario, by \$9 million in 1998/99 rising to a \$45 million loss in 2002. The ice cream processor margin over milk costs rises \$42 million in 2000 and the butter/powder processing margin rises \$24 million. Consumer expenditure is \$34 million lower in 2000.

Producer net incomes (at \$32/hl marginal cost), are reduced by \$86 million in 1998-99, rising to a loss of \$113 million. Consumers gain \$85 million in 1998/99, rising to \$120 million. The estimated net effect on producers and consumers is -\$1 million in 1998/99, rising to +\$7 million by 2002.

In a sub-scenario (scenario 2b), only butterfat is priced in a special class, while the solids not-fat components continue to be priced at Class 2. This significantly moderates the effects of special class pricing. For an increase in milk production of 2.8 mil hl in 2000, producer revenue increases by \$34 million. Processor and consumer effects are similar to scenario 2a, but smaller. Producer net income falls by \$55 million in 2000 while consumer surplus rises by \$44 million for a net loss of about \$10 million.

The third scenario analyses the case where imports continue but MSQ is not reduced to accommodate the increasing supply of imported butterfat, and where the surplus product is exported as butter and powder. Ice cream processors and consumers are not affected, but butter/powder processors increase production. Milk production increases 2.5 mil hl in 2000 as compared to the base and producer revenue increases \$53 million. Producer net income falls about \$27 million in 2000 for a net loss to producers and consumers of \$27 million.

The main conclusions of the analysis are:

- Relative to a baseline where butter blend imports penetrate 40% of ice cream butterfat requirements, milk production and producer's revenues increase if imports are reduced or eliminated. An important consideration is the cost of increased milk production relative to world milk product prices. The greater this cost, the lower is the net income gain to producers of blocking imports. In 1998-99 dairy year, producers gain net income by blocking imports, if the cost of producing that increased production is below \$36/h, but if

costs are above this level they lose net income⁶.

- ↳ Restricting imports, rather than pricing milk to compete against imports is more favorable for producers and less favorable for consumers, other factors held to be equal.
- ↳ Processors of milk products may be differentially affected; ice cream processors lose when input costs increase and demand decreases, but butter/skim milk powder processors may gain.

⁶ The estimates reported in the main text assume a marginal cost of \$32/hl. The sensitivity analysis presented in Section C looks at a wide range of marginal cost.

Table 1: Summary of Production and Revenue Effects (change from base scenario)

		1998	1999	2000	2001	2002
Scenario 1a: Imports of butteroil blend eliminated						
Change in milk production	mil hl	1.8	2.2	2.4	1.8	1.3
Change in producer revenue	mil \$	64.3	78.0	83.6	70.9	59.9
Change in ice cream production	000 tonnes	-3.9	-4.8	-5.0	-5.4	-5.2
Change in ice cream processor margin	mil \$	-7.2	-9.3	-9.8	-10.8	-10.7
Change in skim milk powder production	000 tonnes	16.2	19.6	21.2	17.0	12.8
Change in butter/powder processor margin	mil \$	15.3	18.9	20.8	17.0	13.0
Change in ice cream consumption	000 tonnes	-3.9	-4.8	-5.0	-5.4	-5.2
Change in consumer expenditure	mil \$	6.6	8.4	8.8	9.7	9.5
Scenario 1b: Imports of butteroil blend frozen at 1997 levels						
Change in milk production	mil hl	0.4	0.8	1.0	0.5	0.0
Change in producer revenue	mil \$	15.7	29.4	35.8	24.3	13.8
Change in ice cream production	000 tonnes	-1.0	-1.8	-1.9	-2.3	-2.2
Change in ice cream processor margin	mil \$	-1.8	-3.6	-3.7	-4.6	-4.6
Change in skim milk powder production	000 tonnes	3.9	7.4	9.0	4.8	0.6
Change in butter/powder processor margin	mil \$	3.7	7.1	8.9	4.8	0.6
Change in ice cream consumption	000 tonnes	-1.0	-1.8	-1.9	-2.3	-2.2
Change in consumer expenditure	mil \$	1.6	3.2	3.3	4.1	4.1
Scenario 2a: Establishing a special milk class to compete with imported butteroil blend						
Change in milk production	mil hl	2.4	2.8	3.1	2.6	2.1
Change in producer revenue	mil \$	-9.0	-2.4	-7.3	-28.8	-44.6
Change in ice cream production	000 tonnes	18.2	18.8	21.3	22.7	23.6
Change in ice cream processor margin	mil \$	33.9	36.1	41.7	45.6	48.5
Change in skim milk powder production	000 tonnes	19.1	22.8	24.8	20.8	16.7
Change in butter/powder processor margin	mil \$	18.1	21.9	24.3	20.8	16.9
Change in ice cream consumption	000 tonnes	18.2	18.8	21.3	22.7	23.6
Change in consumer expenditure	mil \$	-28.6	-30.1	-34.4	-37.3	-39.5
Scenario 2b: Establishing a special milk class for butterfat component only						
Change in milk production	mil hl	2.2	2.6	2.8	2.2	1.7
Change in producer revenue	mil \$	19.1	30.8	33.5	19.6	9.5
Change in ice cream production	000 tonnes	9.6	8.8	9.2	8.8	8.4
Change in ice cream processor margin	mil \$	17.8	16.9	18.0	17.6	17.3
Change in skim milk powder production	000 tonnes	18.0	21.5	23.2	19.0	14.6
Change in butter/powder processor margin	mil \$	17.0	20.6	22.7	18.9	14.9
Change in ice cream consumption	000 tonnes	9.6	8.8	9.2	8.8	8.4
Change in consumer expenditure	mil \$	-15.5	-14.6	-15.5	-15.1	-14.8
Scenario 3: Maintain MSQ, export surplus butter						
Change in milk production	mil hl	1.9	2.3	2.5	2.0	1.5
Change in producer revenue	mil \$	42.1	50.9	53.4	40.7	29.7
Change in ice cream production	000 tonnes	0.0	0.0	0.0	0.0	0.0
Change in ice cream processor margin	mil \$	0.0	0.0	0.0	0.0	0.0
Change in skim milk powder production	000 tonnes	15.6	18.9	20.5	16.3	12.1
Change in butter/powder processor margin	mil \$	14.7	18.2	20.1	16.3	12.2
Change in ice cream consumption	000 tonnes	0.0	0.0	0.0	0.0	0.0
Change in consumer expenditure	mil \$	0.0	0.0	0.0	0.0	0.0

Table 2: Summary of Welfare Effects

Effects are expressed as change from the base scenario
assume milk cost = 32 \$/hl

		1998	1999	2000	2001	2002
Scenario 1a: Imports of butteroil blend eliminated						
consumer surplus	mil \$	-17.85	-22.66	-23.85	-26.18	-25.74
producer surplus	mil \$	6.74	8.24	8.03	11.91	17.37
Net change	mil \$	-11.12	-14.42	-15.81	-14.26	-8.37
Scenario 1b: Imports of butteroil blend frozen at 1997 levels						
consumer surplus	mil \$	-4.45	-8.67	-9.07	-11.25	-11.12
producer surplus	mil \$	1.64	3.11	3.56	8.67	14.65
Net change	mil \$	-2.81	-5.56	-5.51	-2.59	3.54
Scenario 2a: Establishing a special milk class to compete with imported butteroil blend						
consumer surplus	mil \$	85.25	89.76	103.65	113.00	120.00
producer surplus	mil \$	-86.16	-93.18	-106.32	-112.85	-112.67
Net change	mil \$	-0.91	-3.42	-2.67	0.15	7.33
Scenario 2b: Establishing a special milk class for butterfat component only						
consumer surplus	mil \$	44.43	41.75	44.44	43.17	42.28
producer surplus	mil \$	-50.38	-51.06	-54.71	-52.00	-45.17
Net change	mil \$	-5.95	-9.31	-10.27	-8.83	-2.88
Scenario 3: Maintain MSQ, export surplus butter						
consumer surplus	mil \$	0.00	0.00	0.00	0.00	0.00
producer surplus	mil \$	-18.90	-23.19	-26.63	-23.11	-17.42
Net change	mil \$	-18.90	-23.19	-26.63	-23.11	-17.42

Notes:

Changes in producer surplus are equivalent to changes in producer net income.

Changes in processor and retailer welfare have not been calculated, but are likely in the same direction as consumer welfare changes.

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A. BACKGROUND

1. Request for Analysis

On December 17, 1997, the Canadian International Trade Tribunal (CITT) was directed by the Governor in Council to undertake an inquiry into the importation of dairy product blends outside the coverage of Canada's tariff rate quotas. The CITT has been asked to report to the Government by July 1, 1998.

On February 12, 1998, the CITT requested that Policy Branch at AAFC provide some simulation analysis of the issue using existing economic models. This request continues a practice that the CITT has found useful in other agricultural related investigations. This paper reports the results of analysis of three main scenarios requested by the CITT.

The first few sections of the paper outline the basic modeling method used, the major assumptions pertinent to the study, a description of the scenarios to be examined and the base scenario. Since the results are sometimes complicated to understand, the initial sections are quite detailed to help give the reader a sound understanding of the issues.

2. Overview of FARM model

FARM is an econometric model used for policy analysis at AAFC. It consists of model components for grains and oilseeds, red meats, dairy and poultry. The model simulates production, consumption and trade for major agricultural commodities, and is used to establish a baseline and alternative scenarios over a future 5-10 year period.

The dairy component of the FARM model has been modified to look at this issue. Essentially the model sums up consumption of dairy products at policy determined prices to determine milk production quotas. Exports and imports of most dairy products are a policy choice in the model and affect the production quota level. Surplus production is exported as butter and skim milk powder. A more complete overview of the dairy model is provided in Appendix 1.

3. Scenario Descriptions

Base Scenario:

- Butteroil/sugar blends are imported, at 10% tariff, up to a level constituting 40% of ice cream butterfat requirements.
- Market sharing quota (MSQ) is determined taking into account the blend imports.
- Target, support and component prices are not affected by the imports, however the mix of production within price classes affects the overall producer price.

Scenario 1: Restrict imports of the blend. Two options are examined:

- (1a) No imports beginning in dairy year 1998/99
- (1b) Current (1997) import levels are "grandfathered", but no further growth

Scenario 2: Price milk inputs to ice cream manufacturers competitively with the dairy component of import blends using a “special class price”, assuming border protection for ice cream remains. Two variations have been run:

- (2a) Butterfat and solids non-fat for ice cream are moved into “Class 5i”
- (2b) Butterfat is priced at “Class 5i”, solids non-fat is priced at Class 2.

Scenario 3: Maintain MSQ without reductions for imports of butteroil/sugar blends and export surplus production (equivalent to the dairy component of import blends) at world prices.

4. Main Assumptions

Assumptions key to the results of this analysis are:

Maximum level of blend imports: The base scenario assumes that imports rise gradually to 40% of ice cream butterfat requirements by 2000, as assumed in earlier analyses⁷. However, it is possible that imports could be much higher, up to 80% or more of ice cream butterfat requirements as discussed in Appendix 2. Another issue is the level of ice cream butterfat requirements. In FARM, ice cream production is defined as the sum of four series (ice cream mix, milkshake mix, sherbert and ice milk mix) and is assumed to contain 10% butterfat (Appendix 1). This leads to total ice cream butterfat requirements of about 22,000 tonnes which is higher than if only ice cream mix were counted. Together, the ice cream production figure and the assumed maximum percentage which would be supplied by imports determine blend imports. Sensitivity of the results to the level of blend imports is reported in Section C.

Value of Blend Imports: The analysis assumes the blend is priced according to world sugar prices and the FOB N. Europe price for butter. It also assumes the low cost supplier, New Zealand, will continue to provide most of the imports at a blend price of about \$2.00/kg. Since there is little border protection in sugar, the Canadian price is equivalent to the landed price. The world price of refined sugar was C\$0.50/kg FOB London in 1996, while the estimated Canadian sugar price was \$0.59/kg. The FOB N. Europe butter price was C\$2.37/kg in 1996. If the butterfat portion of the blend is priced similar to this world price, then it is worth about \$2.90/kg in 1996, meaning processor savings were about \$2.60/kg on the butterfat they purchased in the blend. Appendix 2 provides details of these calculations.

Milk prices: Several milk and milk component prices are used in the analysis. Figure 1 compares the target price, the average milk price received by farmers⁸, international prices for milk and the over-quota milk price (Class 5e). Note that domestic prices are above international prices while the over-quota price is below international prices. In Scenario 2a,

⁷ Correspondence from Dairy Farmers of Canada, September 1997.

⁸ The average price received by milk producers is calculated as farm cash receipts to dairy from Statistics Canada plus the direct payment, divided by total milk production at 3.6% butterfat.

where domestic ingredients for ice cream are priced to compete with imports, a new special class is created, priced at international prices.

Figure 2 compares domestic prices for butter and skim milk powder with international and Class 5e prices. Of note here is the stable Canadian butter price and increasing solids non-fat price, the fact that butter and skim milk powder are expected to be about the same price in international markets and again, the fact that the over-quota milk is priced lower than world prices.

Figure 1: Milk price comparison

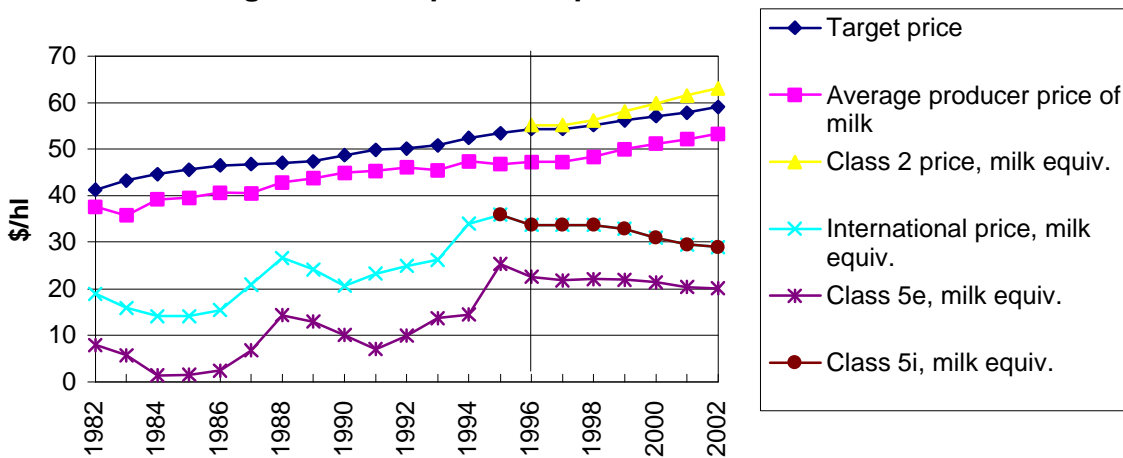
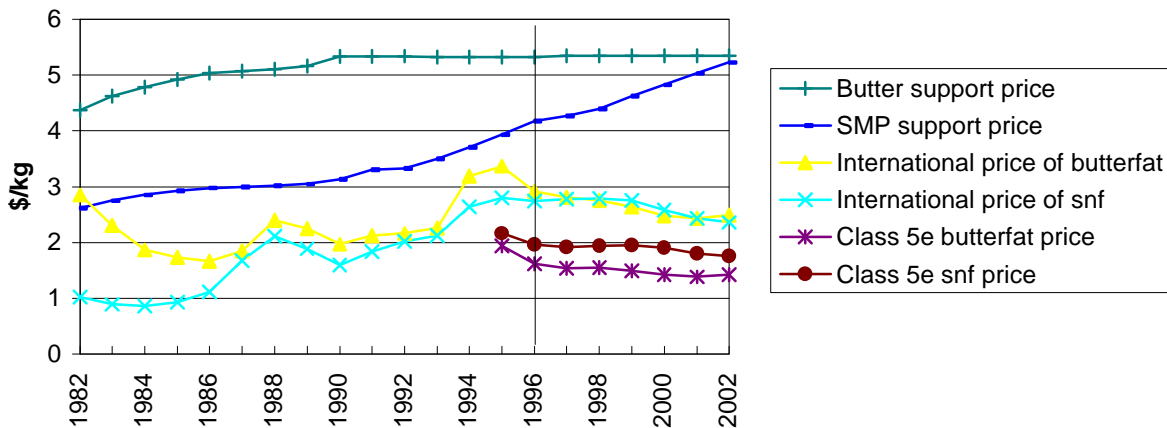


Figure 2: Milk component price comparison



Domestic milk requirements: assume that domestic milk requirements are calculated both in butterfat and solids non-fat terms and MSQ is set to the greater of the two. Domestic requirements equal domestic consumption, minus imports, plus small “planned exports” (e.g. cheddar cheese to United Kingdom).

Ice cream price effect: the analysis assumes changes in milk costs are completely passed through to wholesale and retail prices. This leads to the maximum effect on consumption. It also means that processor and retailer unit margins above milk costs are assumed fixed. Sensitivity of the analysis to this assumption is provided in Section C.

Welfare calculations: Since changes in revenue and expenditure do not capture the full effects of these scenarios on producers and consumers, net income or “welfare” calculations are made. For producer welfare this requires an assumption about the marginal cost of milk production (which is difficult to determine because of the production quotas). \$32/hl is assumed for the main analysis; Appendix 3 discusses the issue in more detail while Section C looks at the impacts of assuming other values.

5. Base Scenario: Imports continue up to maximum level

Table 3 summarizes the main variables in the base scenario relevant to this study:

- Target price increases over the base at about 1.5-2% per year, following a cost of production index.
- Butter support price is constant, while the skim milk powder price increases to cover increases in the target price as well as decreases in the direct payment..
- Total milk production drops in 1998, then remains around 75-76 mil hl. A small increase in fluid production offsets a small decline in MSQ. Over quota production is assumed to remain constant.
- Solids non-fat requirements exceed butterfat requirements beginning in 2000.
- Butter exports decline to the year 2000 and then begin to increase after the crossover. Skim milk powder exports decline rapidly.
- Per capita consumption of ice cream declines slowly over the period.
- Cost of milk ingredients for ice cream is about 91-94 cents per kg. This is a blend of domestic and imported butterfat and domestic solids non-fat.
- Butteroil blend imports reach maximum levels in 2000 and remain there.
- Class 2 component prices follow butter and SMP support prices
- Class 5a-e component prices follow international prices (US and FOB N. Europe)

Crossover Point

Historically, domestic requirements for butterfat were greater than those for solids non-fat, MSQ was based on butterfat requirements, and the excess solids non-fat was exported as skim milk powder. However, butterfat requirements have been falling while solids non-fat requirements have grown. The crossover point is defined as the point when solids non-fat requirements exceed butterfat requirements. Policy changes since the early 1990’s (freezing of the butter support price, price rebates and special (lower priced) classes for some further processors) have delayed the crossover by stimulating demand for butterfat. In the base, the crossover is projected to occur around the year 2000. At this point, the blend imports begin to result, not in lower MSQ levels, but in increased butter exports.

Table 3: Summary of Base Scenario

		1996	1997	1998	1999	2000	2001	2002
Target Price	\$/hl	54.35	54.35	55.13	56.15	57.00	57.79	58.93
Butter support price	\$/kg	5.32	5.35	5.35	5.35	5.35	5.35	5.35
SMP support price	\$/kg	4.18	4.27	4.39	4.62	4.82	5.03	5.22
Direct payment	\$/hl	3.80	3.42	2.66	1.88	1.19	0.38	-
Total milk	mil hl	78.2	77.3	76.0	75.7	75.7	76.2	76.8
Fluid milk	mil hl	31.7	31.8	32.0	32.3	32.5	32.8	33.0
MSQ	mil hl	43.9	42.9	41.4	40.9	40.5	40.8	41.2
Estimated butterfat requirements	mil hl	40.5	41.7	41.4	40.9	40.5	40.3	40.1
Estimated solids non-fat req.	mil hl	39.0	39.7	40.0	40.2	40.5	40.8	41.2
Over-quota milk	mil hl	2.6	2.6	2.6	2.6	2.6	2.6	2.6
Butter exports	000 t	15.6	20.3	15.6	11.2	11.4	13.7	16.0
Skim milk powder net exports	000 t	28.1	48.6	23.2	17.0	11.2	11.0	10.7
ICE CREAM - Supply & Disposition								
Production	000 t	214.7	224.6	223.3	223.5	225.8	227.1	227.7
Consumption	000 t	210.9	220.5	218.9	218.9	220.9	221.9	222.4
Per capita consumption	kg	7.0	7.3	7.2	7.1	7.1	7.0	7.0
Exports	000 t	6.0	6.4	6.8	7.2	7.6	8.0	8.4
Imports	000 t	2.1	2.3	2.4	2.6	2.7	2.8	3.0
Cost of milk ingredients	\$/kg	0.95	0.92	0.91	0.93	0.93	0.94	0.96
Wholesale price	\$/kg	2.77	2.74	2.78	2.85	2.89	2.95	3.02
Consumer price	\$/kg	2.78	2.84	2.94	3.01	3.05	3.11	3.18
Processor margin (\$/kg ice cream)	\$/kg	1.82	1.82	1.86	1.92	1.96	2.01	2.06
Retail margin	\$/kg	0.02	0.10	0.16	0.16	0.16	0.16	0.16
Ice cream butterfat requirements	000 t	21.5	22.5	22.3	22.4	22.6	22.7	22.8
Butteroil/sugar blend imports	000 t	6.6	10.6	14.0	17.0	18.4	18.5	18.6
Bf in blend as % of ice cream requirements		15%	23%	31%	37%	40%	40%	40%
Cost of butterfat in blend	\$/kg	2.92	2.81	2.75	2.63	2.48	2.43	2.49
Component prices, selected classes, Ontario								
Class 2: butterfat	\$/kg	5.49	5.49	5.49	5.49	5.49	5.49	5.49
solids non-fat	\$/kg	4.15	4.15	4.27	4.49	4.69	4.89	5.08
Milk equivalent		55.12	55.12	56.15	58.04	59.69	61.40	63.03
Class 5b: butterfat	\$/kg	3.65	3.67	3.69	3.56	3.41	3.29	3.39
solids non-fat	\$/kg	3.03	2.73	2.76	2.78	2.71	2.57	2.51
Milk equivalent		38.98	36.47	36.77	36.48	35.38	33.76	33.57
Class 5e: butterfat	\$/kg	1.61	1.54	1.55	1.49	1.43	1.38	1.42
solids non-fat	\$/kg	1.96	1.92	1.93	1.95	1.90	1.80	1.76
Milk equivalent		22.53	21.85	22.04	21.97	21.35	20.34	20.10
Farm Cash Receipts		3,532	3,503	3,564	3,705	3,820	3,952	4,092
Total Direct Payment		167	147	110	77	48	16	-
Average Milk Price (incl. subsidy)		47.29	47.23	48.36	49.93	51.12	52.05	53.26

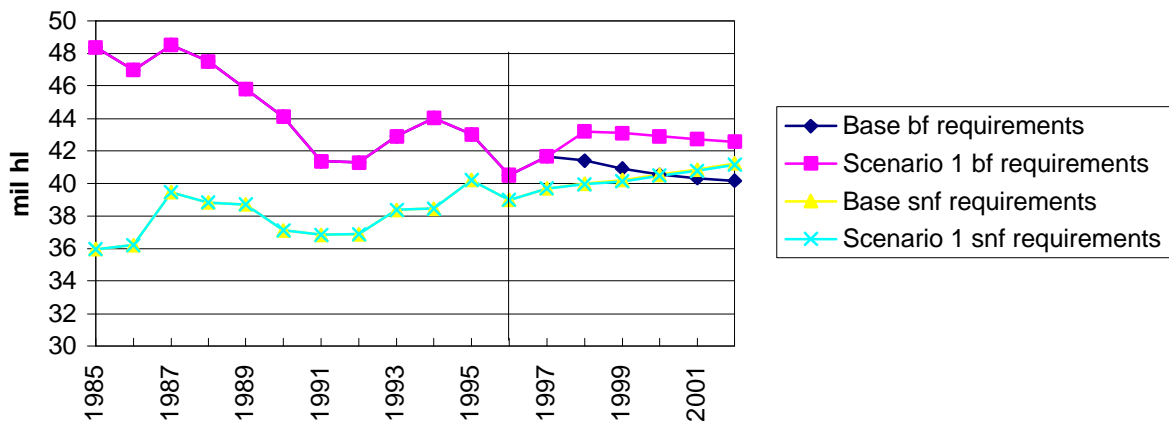
B. SCENARIO RESULTS

This section presents results for the five alternative scenarios. All changes reported are change from the base scenario where imports continue up to a maximum level.. The discussion refers to the summary Tables 1 and 2 presented above as well as to Tables 9-13 at the end of this section which give more detailed results for each scenario. Where the impacts do not change much between different years, the text describes average impacts and where impacts vary considerably between years, a range of impact is reported.

1. Scenario 1a: Imports are reduced to zero

In Scenario 1a, blend imports are blocked beginning in dairy year 1998/99. Domestic butterfat requirements increase accordingly, while solids non-fat requirements are slightly reduced due to the consumption effect. The crossover point is delayed as shown in Figure 3.

Figure 3: Domestic requirements for butterfat and solids non-fat: Base versus Scenario 1a



Milk Producers

MSQ increases by about 2 mil hl or 5-6% which means total milk production increases by 2-3%. Total revenues increase by \$64 mil in the first year, rising to \$84 mil in 1999, then falling to \$60 in 2002. Table 3 shows that these estimates are comparable to those calculated using a simple method presented by the Dairy Farmers of Canada in an analysis sent to AAFC. In the simple method, gains to producers from blocking the imports⁹ are calculated as the butterfat in the imports valued at the Class 2 price for butterfat plus the solids non-fat associated with the increased milk production valued at the Class 5e export price for solids non-fat. The FARM model revenue result is slightly lower than the simple method in initial

⁹ The DFC analysis was in terms of losses to producers due to the imports while here we are talking gains to producers from blocking the imports. The results are identical when the same data is used, except for the sign.

years because it includes the consumption effect and it is considerably lower in later years because of the crossover point.

Table 4: "Simple Method" calculation of gains from blocking imports versus FARM results
 imports rise to 40% of ice cream requirements in 2000

		1996	1997	1998	1999	2000	2001	2002
Dairy year blend imports	000 t	6.6	10.6	14.0	17.0	18.4	18.5	18.6
Butterfat equivalent (49%)	000 t	3.2	5.2	6.9	8.3	9.0	9.1	9.1
"Simple method" calculations								
Milk equivalent of imports	mil hl	0.9	1.4	1.9	2.3	2.5	2.5	2.5
butterfat	000 t	3.2	5.2	6.9	8.3	9.0	9.1	9.1
solids non-fat	000 t	7.7	12.3	16.2	19.7	21.4	21.5	21.6
Class 2 price for butterfat	\$/kg	5.49	5.49	5.49	5.49	5.49	5.49	5.49
Class 5e price for solids non-fat	\$/kg	1.96	1.92	1.93	1.95	1.90	1.80	1.76
Estimated revenue gain	mil \$	32.8	52.0	69.1	84.2	90.3	88.6	87.9
FARM calculations								
Estimated revenue gain	mil \$			64.3	79.1	83.6	70.8	59.8
Milk production increase	mil hl			1.8	2.2	2.4	1.8	1.3
Change in total milk to ice cream	mil hl			-0.1	-0.1	-0.1	-0.2	-0.1

Producer revenue increases are higher before the base period crossover point (2000), but lower after because there was surplus butterfat after 2000 in the base. When blend imports are blocked, the change in MSQ is lower than it would be if base MSQ were in butterfat.

The average milk price falls by about 1%. Depending on the underlying cost, the change in producer surplus can be positive or negative. With marginal cost of \$36/hl or lower, producer surplus is increased by the scenario. Marginal cost of over \$36/hl leads to a drop in producer surplus. Appendix 3 describes the issues in more detail and Section C provides some sensitivity analysis related to this assumption

The reduction in average price and potentially negative change in producer surplus is, at first, surprising. It occurs because the mix of sales between milk classes changes due to the scenario. Table 5 describes the change in revenue by milk class. The increase in MSQ (1.9 mil hl in 1998) results in increased butterfat (6.9 kt) sold at class 2 price and additional solids non-fat (16.2 kt) which is exported and receives the low class 5e price.

Table 5: Change in producer revenue by class: scenario 1a-base

	1998	1998	1998	1998	2002	2002	2002	2002
	quantity of	bf revenue	quantity of	snf revenue	quantity of	bf revenue	quantity of	snf revenue
	bf (kt)	(mil \$)	snf (kt)	(mil \$)	bf (kt)	(mil \$)	snf (kt)	(mil \$)
Class 1A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 1B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 2	6.86	37.66	0.00	0.00	8.59	47.16	-0.54	-2.77
Class 3A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 3B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 4A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 4B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5E	0.05	0.08	16.24	31.39	-3.82	-5.43	11.87	20.87
Class 5I	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Change in total quantity				1.9 mil hl				1.3 mil hl
Change in total revenue				69 mil \$				60 mil \$
Average revenue				36 \$/hl				45 \$/hl

Ice Cream Processors

Ice cream production declines 2%. Milk ingredient costs increase \$0.08 in the first year rising to \$0.12 or about 12% of base milk ingredient costs as the cheaper imports are replaced by domestic butterfat priced at Class 2. Since the increased milk costs are assumed to be passed on to consumers, the unit margin remains constant and wholesale prices increase. The total revenue over milk cost (the 'margin') declines 2% (\$7-11 mil) in line with the fall in production.

Change in revenue over milk costs is given as an indicator of overall change in the processing sector, but is not a measure of the welfare change to processors. The current structure of the FARM model, by assuming fixed margin over milk costs, implicitly implies that the processor (and retailer) welfare change of these scenarios is zero. However, it is expected that the scenarios will have some impact on processor welfare, and that the change will be in the same direction as the margin changes, but significantly smaller. A similar result holds for retailers in this analysis, however the changes in margins for this sector are not presented.

If changes in milk costs are not fully passed through to consumers, the impacts on production and processor welfare would be different. Section C looks at a simple sensitivity test on this. The question of the welfare impact of these scenarios on processors and retailers is an area where further analysis could be done; if FARM were used it would require some significant respecification of the model.

Butter/Powder Processors

Skim milk powder production increases substantially (30-50%) as the industry is once more in a state of significant skim milk powder surplus. Total revenue over milk cost for butter/powder processors is projected to increase a corresponding 30-50% (\$20 mil). As with ice cream, unit margins are assumed to remain constant.

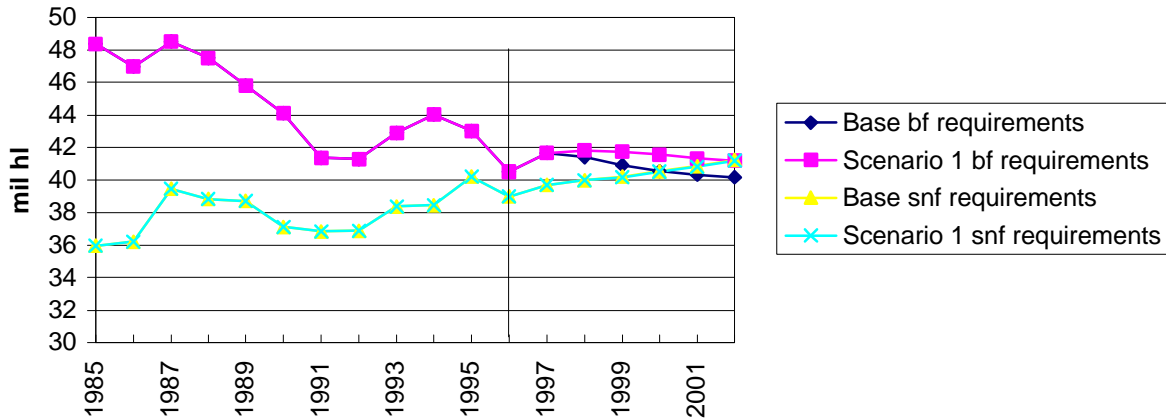
Ice Cream Consumers

As in the processing sector, it is assumed that changes in wholesale prices are completely passed through by the retail sector to consumers. In this scenario, this leads to a retail ice cream price increase of 3-4%. Consumption falls 2% and total consumer expenditure on ice cream increases \$7-10 mil. Consumers are paying higher prices and consuming less ice cream and consumer surplus is estimated to fall by \$18 mil in the first year, rising to a \$26 mil loss in 2002.

2. Scenario 1b: Imports are fixed at 1996/97 levels

In this scenario, imports are kept at the 1997 level, rather than increasing as in the base. The results are similar in direction to Scenario 1a but substantially smaller in magnitude. Blend imports are still fairly high, representing 20% of ice cream butterfat requirements. Figure 4 shows domestic requirements in this case.

Figure 4: Domestic requirements for butterfat and solids non-fat: Base versus Scenario 1b



Milk Producers

Total milk production increases 0.5-1 mil hl or 1%. Total producer revenues increase 1% (\$30 mil). Average price falls less than 1%. Change in producer surplus is small in initial years, rising to +\$14 mil in later years.

Ice Cream Processors

Production declines 1%. Total revenue over milk cost declines 1% (-\$4 mil).

Butter/Powder Processors

Butter/powder production increases about 17%. Total revenue over milk cost increases \$7 mil.

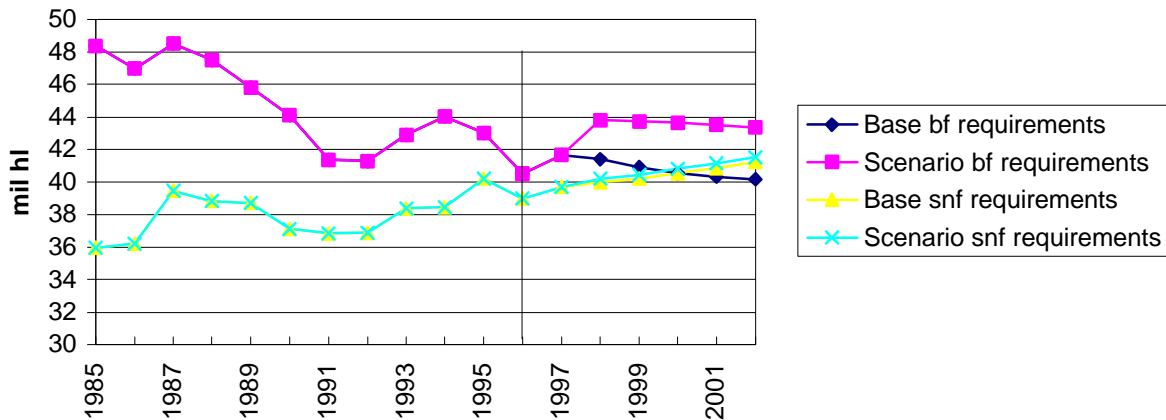
Ice Cream Consumers

Retail price increases 1-2% . Consumption falls 1%. Total expenditure increases \$1-4 mil. Change in consumer surplus is initially -\$4 mil, rising to -\$11 mil in 2002.

3. Scenario 2a: Butterfat and solids non-fat for ice cream are priced at Class 5i

In this scenario, all ice cream milk ingredients are priced at the class 5i price. The lower priced domestic production is assumed to replace all imports. The price effects at both the producer and consumer level are fairly large because now all of the solids non-fat and butterfat going to ice cream are priced at the lower class 5i price (as opposed to 40% of butterfat requirements being priced at lower prices in the base). The effect on milk production is larger than in Scenario 1a due to positive consumption effects. Ice cream production and consumption increase in this scenario. Figure 5 shows domestic requirements under scenario 2a.

Figure 5: Domestic requirements for butterfat and solids non-fat: Base versus Scenario 2a



Milk Producers

Milk production increases by up to 3.1 mil hl or 3-4%. Total revenues are lower than in the base by about \$9 million in early years, rising to a \$45 million loss in later years. Average price falls 3-4%. Change in producer surplus is roughly -\$100 mil.

As with scenario 1a, a more direct method of calculating the change in producer revenue is compared with the FARM results. Table 6 shows that the simple method yields revenue losses similar to those from FARM. Again, the main reason for the differences is that FARM includes consumption and crossover effects.

Table 6: "Simple Method" calculation of Scenario 2a versus FARM results

		1996	1997	1998	1999	2000	2001	2002
Dairy year blend imports	000 t a	6.6	10.6	14.0	17.0	18.4	18.5	18.6
butterfat equiv.	000 t b	3.2	5.2	6.9	8.3	9.0	9.1	9.1
as % of ice cream	c	15%	23%	31%	37%	40%	40%	40%
Simple calculations								
Milk equivalent of imports	d	0.9	1.4	1.9	2.3	2.5	2.5	2.5
Total butterfat requirements for ice cream	000 t e	21.5	22.5	22.2	22.4	22.6	22.7	22.8
Total solids non-fat "	000 t f	22.5	23.6	23.3	23.5	23.7	23.8	23.9
Lose class 2 price for butterfat on 60%	\$/kg g	5.49	5.49	5.49	5.49	5.49	5.49	5.49
Lose class 2 price for solids non-fat	\$/kg h	4.15	4.15	4.27	4.50	4.70	4.90	5.09
Get class 5i price for butterfat on 100%	\$/kg i	2.91	2.80	2.75	2.63	2.48	2.43	2.49
Get class 5i price for solids non-fat 100%	\$/kg j	2.73	2.77	2.79	2.75	2.58	2.43	2.36
Sell excess smp at class 5e	k	1.96	1.92	1.93	1.95	1.90	1.80	1.76
Estimated revenue change	mil \$ m	-14.2	-7.8	-1.3	-1.9	-11.9	-24.4	-30.9
FARM calculations								
Estimate of revenue change	mil \$			-7.8	-1.3	-7.4	-28.9	-44.6
Milk production change	mil hl			2.4	2.9	3.1	2.6	2.1
Change in total milk to ice cream	mil hl			1.0	1.0	1.2	1.3	1.3

Note: "simple method" of estimating change is: $m=(1-c)*e*(-g)+c*i+f*(j-h)+(e*8.52/3.6-f)*k$

Table 7 shows that scenario 2a leads to decreased sales of butterfat and solids non-fat in Class 2, increased sales of butterfat in Class 5i, and increased sales of skim milk powder in both class 5i and 5e. The change in revenue associated with these increased sales is negative. Sensitivity analysis in Section C shows that there would be positive revenue on these increased sales if Class 5i were priced higher.

Table 7: Change in producer revenue by class: scenario 2a-base

	1998	1998	1998	1998	2002	2002	2002	2002
	quantity of	bf revenue	quantity of	snf revenue	quantity of	bf revenue	quantity of	snf revenue
	bf (kt)	(mil \$)	snf (kt)	(mil \$)	bf (kt)	(mil \$)	snf (kt)	(mil \$)
Class 1A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 1B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 2	-14.70	-80.69	-22.64	-96.67	-12.83	-70.43	-23.03	-116.97
Class 3A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 3B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 4A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 4B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5E	0.06	0.09	18.76	36.27	-3.82	-5.43	15.66	27.53
Class 5I	23.47	64.50	24.65	68.71	24.30	60.52	25.51	60.15
Change in total quantity				2.5 mil hl				2.1 mil hl
Change in total revenue				-8 mil \$				-45 mil \$
Average revenue				-3 \$/hl				-21 \$/hl

Ice Cream Processors

Production increases 8-10%. Total revenue over milk cost increases about \$40 mil.

Butter/Powder Processors

Again, butter powder processors increase production in this scenario as **solids non-fat** is surplus and exported as skim milk powder.

Ice Cream Consumers

Retail price declines 13% . Consumption rises 10%. Total expenditure declines (30-40 mil). Increase in consumer surplus rises from \$85 mil in the initial year to \$120 mil in 2002.

4. Scenario 2b: Butterfat for ice cream priced at Class 5i, solids non-fat priced class 2

In this scenario, all butterfat for ice cream production is priced at class 5i while solids non-fat is priced at class 2. Again, the lower priced domestic production is assumed to replace all imports. As expected, the price drop to producers is larger than in Scenario 1a, but less than 2a. The effect on milk production is similar to 1a, however ice cream production and consumption both increase in this scenario where they decrease in 1a.

Milk Producers

Production increases by up to 2.8 mil hl or 3-4%. Total revenues increase 1% (\$30 mil). Average price falls 2%. Change in producer surplus is roughly -\$50 mil.

Table 8: Change in producer revenue by class: scenario 2b-base

	1998	1998	1998	1998	2002	2002	2002	2002
	qbf	bfrev	qsnf	snf rev	qbf	bf rev	qsnf	snf rev
Class 1A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 1B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 2	-14.70	-80.69	1.10	4.72	-12.83	-70.43	0.88	4.48
Class 3A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 3B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 4A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 4B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5D	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Class 5E	0.05	0.08	17.62	34.07	-3.82	-5.43	13.66	24.02
Class 5I	22.61	62.12	0.00	0.00	22.78	56.74	0.00	0.00
Change in total quantity				2.2 mil hl				1.7 mil hl
Change in total revenue				20 mil \$				9 mil \$
Average revenue				9 \$/hl				6 \$/hl

Ice Cream Processors

Production increases 4%. Revenue over milk cost increases \$17 mil.

Butter/Powder processors

Production increases 30-50%. Total revenue over milk cost increases \$20 mil.

Ice Cream Consumers

Retail price declines 6% . Consumption rises 4%. Total expenditure declines (\$15 mil). The increase in consumer surplus is roughly \$40 mil.

5. Scenario 3: Maintain MSQ, export surplus butter

In scenario 3, imports are maintained, but MSQ is not reduced accordingly. Surplus milk is processed into butter and powder and exports of both increase substantially.

Milk Producers

Production increases 2 mil hl or 3%. Total revenues increase 1% (50 mil). Average price falls 2%. Change in producer surplus is roughly -\$25 mil.

Ice Cream Processors & Consumers: no impact

Butter/Powder processors

Increased production by 40%, total revenue over milk cost increases \$18 mil.

Table 9: Results Scenario 1a: Imports of butteroil blend eliminated beginning in 1998/99

		1996	1997	1998	1999	2000	2001	2002
Blend imports	000 t bf	3.23	5.19	0.00	0.00	0.00	0.00	0.00
Domestic requirements								
butterfat	mil hl	40.5	41.7	43.2	43.1	42.9	42.7	42.5
solids non-fat	mil hl	39.0	39.7	39.9	40.2	40.5	40.8	41.1
Farm Revenue								
Total revenue	mil \$	3,532	3,503	3,628	3,785	3,904	4,023	4,152
Direct payment	mil \$	167	147	115	81	51	16	-
Total milk production	mil hl	78.2	77.3	77.8	78.0	78.0	78.1	78.2
Average price (incl. pmt)	\$/hl	47.3	47.2	48.1	49.6	50.7	51.7	53.1
Surplus Production								
butter exports	000 t	15.6	20.3	15.6	11.1	11.3	11.3	11.3
powder exports	000 t	28.1	48.6	39.4	36.8	32.4	28.0	23.5
Processor Returns								
Ice cream milk cost	\$/kg	0.95	0.92	1.00	1.02	1.04	1.06	1.08
Ice cream production	000 t	214.7	224.6	219.4	219.6	220.8	221.7	222.5
Ice cream margin	mil \$	390.7	409.1	408.9	421.5	432.6	444.7	458.2
Skim milk powder production	000 t	61.9	71.8	70.4	67.9	63.8	59.5	55.3
Butter/powder margin	mil \$	58.2	67.6	66.6	65.3	62.5	59.4	56.1
Consumer Expenditure on Ice cream								
Ice cream consumption	000 t	210.9	220.5	215.1	215.0	215.9	216.5	217.2
Retail price	\$/kg	2.78	2.84	3.02	3.10	3.16	3.23	3.30
Total expenditure	mil \$	587.1	626.5	649.7	666.5	682.4	699.1	716.9
Change from base								
Blend imports	000 t bf	0.00	0.00	-6.86	-8.33	-9.03	-9.08	-9.11
		0%	0%	-100%	-100%	-100%	-100%	-100%
Domestic requirements								
butterfat	mil hl	0.0	0.0	1.8	2.2	2.4	2.4	2.4
		0%	0%	4.3%	5.3%	5.8%	5.9%	5.9%
solids non-fat	mil hl	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
		0%	0%	0%	0%	0%	0%	0%
Farm Revenue								
Total revenue	mil \$	-	-	64	78	84	71	60
		0%	0%	2%	2%	2%	2%	1%
Total milk production	mil hl	0.0	0.0	1.8	2.2	2.4	1.8	1.3
		0%	0%	2%	3%	3%	2%	2%
Average price (incl. pmt)	\$/hl	0.00	0.00	-0.23	-0.34	-0.44	-0.31	-0.14
		0%	0%	0%	-1%	-1%	-1%	0%
Surplus Production								
butter exports	000 t	0.00	0.00	0.00	-0.06	-0.10	-2.33	-4.67
		0%	0%	0%	-1%	-1%	-17%	-29%
powder exports	000 t	0.00	0.00	16.16	19.61	21.24	17.04	12.80
		0%	0%	70%	114%	190%	155%	119%
Processor Returns								
Ice cream milk cost	\$/kg	0.00	0.00	0.08	0.11	0.11	0.12	0.12
		0%	0%	9%	12%	12%	13%	12%
Ice cream production	000 t	0.00	0.00	-3.89	-4.85	-5.01	-5.40	-5.19
		0%	0%	-2%	-2%	-2%	-2%	-2%
Ice cream margin	mil \$	0.00	0.00	-7.25	-9.31	-9.82	-10.84	-10.68
		0%	0%	-2%	-2%	-2%	-2%	-2%
Skim milk powder production	000 t	-	-	16.2	19.6	21.2	17.0	12.8
		0%	0%	30%	41%	50%	40%	30%
Butter/powder margin	mil \$	0.00	0.00	15.28	18.85	20.81	16.99	13.00
		0%	0%	30%	41%	50%	40%	30%
Consumer Expenditure on Ice cream								
Ice cream consumption	000 t	0.00	0.00	-3.89	-4.85	-5.01	-5.40	-5.19
		0%	0%	-2%	-2%	-2%	-2%	-2%
Retail price	\$/kg	0.00	0.00	0.08	0.11	0.11	0.12	0.12
		0%	0%	3%	4%	4%	4%	4%
Total expenditure	mil \$	0.00	0.00	6.59	8.40	8.84	9.72	9.54
		0%	0%	1%	1%	1%	1%	1%

Table 10: Results Scenario 1b: Imports of butteroil blend frozen at 1997 levels beginning in 199

		1996	1997	1998	1999	2000	2001	2002
Blend imports	000 t bf	3.23	5.19	5.19	5.19	5.19	5.19	5.19
Domestic requirements								
butterfat	mil hl	40.5	41.7	41.8	41.7	41.5	41.3	41.2
solids non-fat	mil hl	39.0	39.7	40.0	40.2	40.5	40.8	41.2
Farm Revenue								
Total revenue	mil \$	3,532	3,503	3,580	3,736	3,856	3,977	4,106
Direct payment	mil \$	167	147	111	78	49	16	-
Total milk production	mil hl	78.2	77.3	76.4	76.6	76.7	76.7	76.8
Average price (incl. pmt)	\$/hl	47.3	47.2	48.3	49.8	50.9	52.0	53.5
Surplus Production								
butter exports	000 t	15.6	20.3	15.6	11.2	11.3	11.3	11.3
powder exports	000 t	28.1	48.6	27.1	24.6	20.2	15.8	11.3
Processor Returns								
Ice cream milk cost	\$/kg	0.95	0.92	0.93	0.95	0.97	0.99	1.01
Ice cream production	000 t	214.7	224.6	222.3	222.6	223.9	224.7	225.5
Ice cream margin	mil \$	390.7	409.1	414.4	427.3	438.7	450.9	464.3
Skim milk powder production	000 t	61.9	71.8	58.2	55.7	51.6	47.3	43.1
Butter/powder margin	mil \$	58.2	67.6	55.0	53.5	50.5	47.2	43.7
Consumer Expenditure on Ice cream								
Ice cream consumption	000 t	210.9	220.5	218.0	218.0	219.0	219.6	220.1
Retail price	\$/kg	2.78	2.84	2.96	3.03	3.09	3.16	3.23
Total expenditure	mil \$	587.1	626.5	644.7	661.3	676.8	693.5	711.4
Change from base								
		1996	1997	1998	1999	2000	2001	2002
Blend imports	000 t bf	0.00	0.00	-1.67	-3.14	-3.84	-3.90	-3.92
		0%	0%	-24%	-38%	-43%	-43%	-43%
Domestic requirements								
butterfat	mil hl	0.0	0.0	0.4	0.8	1.0	1.0	1.0
		0%	0%	1%	2%	3%	3%	3%
solids non-fat	mil hl	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0%	0%	0%	0%	0%	0%	0%
Farm Revenue								
Total revenue	mil \$	-	-	16	29	36	24	14
		0%	0%	0%	1%	1%	1%	0%
Total milk production	mil hl	0.0	0.0	0.4	0.8	1.0	0.5	0.0
		0%	0%	0.6%	1.1%	1.3%	0.6%	0.0%
Average price (incl. pmt)	\$/hl	0.00	0.00	-0.06	-0.13	-0.19	-0.01	0.20
		0%	0.0%	-0.1%	-0.3%	-0.4%	0.0%	0.4%
Surplus Production								
butter exports	000 t	0.00	0.00	0.00	-0.01	-0.06	-2.29	-4.61
		0%	0%	0%	0%	0%	-17%	-29%
powder exports	000 t	0.00	0.00	3.94	7.40	9.04	4.83	0.60
		0%	0%	17%	43%	81%	44%	6%
Processor Returns								
Ice cream milk cost	\$/kg	0.00	0.00	0.02	0.04	0.04	0.05	0.05
		0%	0%	2%	4%	4%	5%	5%
Ice cream production	000 t	0.00	0.00	-0.97	-1.85	-1.90	-2.32	-2.23
		0%	0%	0%	-1%	-1%	-1%	-1%
Ice cream margin	mil \$	0.00	0.00	-1.80	-3.55	-3.72	-4.65	-4.60
		0%	0%	0%	-1%	-1%	-1%	-1%
Skim milk powder production	000 t	-	-	3.9	7.4	9.0	4.8	0.6
		0%	0%	7%	15%	21%	11%	1%
Butter/powder margin	mil \$	0.00	0.00	3.72	7.11	8.86	4.82	0.61
		0%	0%	7%	15%	21%	11%	1%
Consumer Expenditure on Ice cream								
Ice cream consumption	000 t	0.00	0.00	-0.97	-1.85	-1.90	-2.32	-2.23
		0%	0%	0%	-1%	-1%	-1%	-1%
Retail price	\$/kg	0.00	0.00	0.02	0.04	0.04	0.05	0.05
		0%	0%	1%	1%	1%	2%	2%
Total expenditure	mil \$	0.00	0.00	1.62	3.17	3.32	4.12	4.07
		0%	0.0%	0.3%	0.5%	0.5%	0.6%	0.6%

Table 11: Results Scenario 2a: Establishing a special milk class to compete with imported blend

		1996	1997	1998	1999	2000	2001	2002
Blend imports	000 t bf	3.23	5.19	0.00	0.00	0.00	0.00	0.00
Domestic requirements								
butterfat	mil hl	40.5	41.7	43.8	43.7	43.6	43.5	43.3
solids non-fat	mil hl	39.0	39.7	40.2	40.4	40.8	41.1	41.5
Farm Revenue								
Total revenue	mil \$	3,532	3,503	3,555	3,704	3,813	3,924	4,048
Direct payment	mil \$	167	147	116	82	52	17	-
Total milk production	mil hl	78.2	77.3	78.4	78.6	78.8	78.9	79.0
Average price (incl. pmt)	\$/hl	47.3	47.2	46.8	48.2	49.1	50.0	51.3
Surplus Production								
butter exports	000 t	15.6	20.3	15.6	11.1	11.3	11.3	11.3
powder exports	000 t	28.1	48.6	42.3	40.0	36.0	31.8	27.4
Processor Returns								
Ice cream milk cost	\$/kg	0.95	0.92	0.57	0.55	0.52	0.50	0.50
Ice cream production	000 t	214.7	224.6	241.5	243.2	247.0	249.8	251.3
Ice cream margin	mil \$	390.7	409.1	450.1	466.9	484.1	501.2	517.4
Skim milk powder production	000 t	61.9	71.8	73.4	71.1	67.3	63.4	59.2
Butter/powder margin	mil \$	58.2	67.6	69.4	68.4	65.9	63.2	60.1
Consumer Expenditure on Ice cream								
Ice cream consumption	000 t	210.9	220.5	237.1	238.6	242.2	244.7	245.9
Retail price	\$/kg	2.78	2.84	2.59	2.63	2.64	2.66	2.72
Total expenditure	mil \$	587.1	626.5	614.5	628.0	639.1	652.0	667.9
Change from base								
		1996	1997	1998	1999	2000	2001	2002
Blend imports	000 t bf	0.00	0.00	-6.86	-8.33	-9.03	-9.08	-9.11
		0%	0%	-100%	-100%	-100%	-100%	-100%
Domestic requirements								
butterfat	mil hl	0.0	0.0	2.4	2.8	3.1	3.2	3.2
		0%	0%	6%	7%	8%	8%	8%
solids non-fat	mil hl	0.0	0.0	0.2	0.2	0.3	0.3	0.3
		0%	0%	1%	1%	1%	1%	1%
Farm Revenue								
Total revenue	mil \$	-	-	(9)	(2)	(7)	(29)	(45)
		0%	0%	0%	0%	0%	-1%	-1%
Total milk production	mil hl	0.0	0.0	2.4	2.8	3.1	2.6	2.1
		0%	0%	3%	4%	4%	3%	3%
Average price (incl. pmt)	\$/hl	0.00	0.00	-1.52	-1.76	-2.05	-2.09	-2.00
		0%	0%	-3%	-4%	-4%	-4%	-4%
Surplus Production								
butter exports	000 t	0.00	0.00	0.00	-0.07	-0.11	-2.35	-4.68
		0%	0%	0%	-1%	-1%	-17%	-29%
powder exports	000 t	0.00	0.00	19.15	22.81	24.80	20.85	16.70
		0%	0%	83%	133%	222%	190%	155%
Processor Returns								
Ice cream milk cost	\$/kg	0.00	0.00	-0.35	-0.36	-0.41	-0.44	-0.47
		0%	0%	-38%	-40%	-44%	-47%	-48%
Ice cream production	000 t	0.00	0.00	18.20	18.79	21.28	22.75	23.58
		0%	0%	8%	8%	9%	10%	10%
Ice cream margin	mil \$	0.00	0.00	33.91	36.08	41.69	45.64	48.54
		0%	0%	8%	8%	9%	10%	10%
Skim milk powder production	000 t	-	-	19.1	22.8	24.8	20.8	16.7
		0%	0%	35%	47%	58%	49%	39%
Butter/powder margin	mil \$	0.00	0.00	18.10	21.93	24.29	20.79	16.95
		0%	0%	35%	47%	58%	49%	39%
Consumer Expenditure on Ice cream								
Ice cream consumption	000 t	0.00	0.00	18.20	18.79	21.28	22.75	23.58
		0%	0%	8%	9%	10%	10%	11%
Retail price	\$/kg	0.00	0.00	-0.35	-0.36	-0.41	-0.44	-0.47
		0%	0%	-12%	-12%	-13%	-14%	-15%
Total expenditure	mil \$	0.00	0.00	-28.65	-30.09	-34.42	-37.32	-39.50
		0%	0%	-4%	-5%	-5%	-5%	-6%

Table 12: Results Scenario 2b: Establishing a special milk class for butterfat component only

		1996	1997	1998	1999	2000	2001	2002
Blend imports	000 t bf	3.23	5.19	0.00	0.00	0.00	0.00	0.00
Domestic requirements								
butterfat	mil hl	40.5	41.7	43.5	43.5	43.3	43.1	42.9
solids non-fat	mil hl	39.0	39.7	40.1	40.3	40.7	41.0	41.3
Farm Revenue								
Total revenue	mil \$	3,532	3,503	3,583	3,737	3,854	3,972	4,102
Direct payment	mil \$	167	147	116	82	52	16	-
Total milk production	mil hl	78.2	77.3	78.1	78.3	78.4	78.5	78.5
Average price (incl. pmt)	\$/hl	47.3	47.2	47.3	48.8	49.8	50.8	52.2
Surplus Production								
butter exports	000 t	15.6	20.3	15.6	11.1	11.3	11.3	11.3
powder exports	000 t	28.1	48.6	41.2	38.6	34.4	30.0	25.4
Processor Returns								
Ice cream milk cost	\$/kg	0.95	0.92	0.72	0.73	0.74	0.76	0.78
Ice cream production	000 t	214.7	224.6	232.9	233.2	235.0	235.8	236.1
Ice cream margin	mil \$	390.7	409.1	434.0	447.8	460.4	473.2	486.2
Skim milk powder production	000 t	61.9	71.8	72.2	69.8	65.7	61.5	57.2
Butter/powder margin	mil \$	58.2	67.6	68.3	67.1	64.3	61.3	58.0
Consumer Expenditure on Ice cream								
Ice cream consumption	000 t	210.9	220.5	228.5	228.6	230.1	230.7	230.8
Retail price	\$/kg	2.78	2.84	2.75	2.81	2.86	2.92	3.00
Total expenditure	mil \$	587.1	626.5	627.7	643.5	658.0	674.3	692.6
Change from base								
		1996	1997	1998	1999	2000	2001	2002
Blend imports	000 t bf	0.00	0.00	-6.86	-8.33	-9.03	-9.08	-9.11
		0%	0%	-100%	-100%	-100%	-100%	-100%
Domestic requirements								
butterfat	mil hl	0.0	0.0	2.2	2.6	2.8	2.8	2.8
		0%	0%	5%	6%	7%	7%	7%
solids non-fat	mil hl	0.0	0.0	0.1	0.1	0.1	0.1	0.1
		0%	0%	0%	0%	0%	0%	0%
Farm Revenue								
Total revenue	mil \$	-	-	19	31	34	20	9
		0%	0%	1%	1%	1%	0%	0%
Total milk production	mil hl	0.0	0.0	2.2	2.6	2.8	2.2	1.7
		0%	0%	3%	3%	4%	3%	2%
Average price (incl. pmt)	\$/hl	0.00	0.00	-1.03	-1.18	-1.33	-1.22	-1.04
		0%	0%	-2%	-2%	-3%	-2%	-2%
Surplus Production								
butter exports	000 t	0.00	0.00	0.00	-0.07	-0.11	-2.34	-4.67
		0%	0%	0%	-1%	-1%	-17%	-29%
powder exports	000 t	0.00	0.00	17.98	21.46	23.17	18.96	14.65
		0%	0%	78%	125%	207%	172%	136%
Processor Returns								
Ice cream milk cost	\$/kg	0.00	0.00	-0.19	-0.18	-0.19	-0.18	-0.18
		0%	0%	-21%	-20%	-20%	-20%	-19%
Ice cream production	000 t	0.00	0.00	9.55	8.81	9.21	8.79	8.41
		0%	0%	4%	4%	4%	4%	4%
Ice cream margin	mil \$	0.00	0.00	17.80	16.92	18.05	17.63	17.31
		0%	0%	4%	4%	4%	4%	4%
Skim milk powder production	000 t	-	-	18.0	21.5	23.2	19.0	14.6
		0%	0%	33%	44%	54%	45%	34%
Butter/powder margin	mil \$	0.00	0.00	16.99	20.63	22.69	18.90	14.86
		0%	0%	33%	44%	54%	45%	34%
Consumer Expenditure on Ice cream								
Ice cream consumption	000 t	0.00	0.00	9.55	8.81	9.21	8.79	8.41
		0%	0%	4%	4%	4%	4%	4%
Retail price	\$/kg	0.00	0.00	-0.19	-0.18	-0.19	-0.18	-0.18
		0%	0%	-6%	-6%	-6%	-6%	-6%
Total expenditure	mil \$	0.00	0.00	-15.46	-14.58	-15.49	-15.07	-14.78
		0%	0%	-2%	-2%	-2%	-2%	-2%

Table 13: Results Scenario 3: Maintain MSQ, export surplus butter

		1996	1997	1998	1999	2000	2001	2002
Blend imports	000 t bf	3.23	5.19	6.86	8.33	9.03	9.08	9.11
Domestic requirements								
butterfat	mil hl	40.5	41.7	43.3	43.2	43.0	42.8	42.7
solids non-fat	mil hl	39.0	39.7	40.0	40.2	40.5	40.8	41.2
Farm Revenue								
Total revenue	mil \$	3,532	3,503	3,606	3,757	3,874	3,993	4,122
Direct payment	mil \$	167	147	115	81	51	16	-
Total milk production	mil hl	78.2	77.3	77.9	78.1	78.2	78.2	78.3
Average price (incl. pmt)	\$/hl	47.3	47.2	47.8	49.2	50.2	51.3	52.6
Surplus Production								
butter exports	000 t	15.6	20.3	24.0	21.3	22.3	22.5	22.5
powder exports	000 t	28.1	48.6	38.8	36.1	31.7	27.3	22.8
Processor Returns								
Ice cream milk cost	\$/kg	0.95	0.92	0.91	0.91	0.93	0.94	0.96
Ice cream production	000 t	214.7	224.6	223.3	224.4	225.8	227.1	227.7
Ice cream margin	mil \$	390.7	409.1	416.2	430.8	442.4	455.5	468.9
Skim milk powder production	000 t	61.9	71.8	69.8	67.2	63.0	58.8	54.6
Butter/powder margin	mil \$	58.2	67.6	66.0	64.6	61.7	58.7	55.4
Consumer Expenditure on Ice cream								
Ice cream consumption	000 t	210.9	220.5	218.9	219.8	220.9	221.9	222.4
Retail price	\$/kg	2.78	2.84	2.94	2.99	3.05	3.11	3.18
Total expenditure	mil \$	587.1	626.5	643.1	658.1	673.5	689.3	707.4
Change from base								
		1996	1997	1998	1999	2000	2001	2002
Blend imports	000 t bf	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0%	0%	0%	0%	0%	0%	0%
Domestic requirements								
butterfat	mil hl	0.0	0.0	1.9	2.3	2.5	2.5	2.5
		0%	0%	5%	6%	6%	6%	6%
solids non-fat	mil hl	0.0	0.0	0.0	0.0	0.0	0.0	0.0
		0%	0%	0%	0%	0%	0%	0%
Farm Revenue								
Total revenue	mil \$	-	-	42	51	53	41	30
		0%	0%	1%	1%	1%	1%	1%
Total milk production	mil hl	0.0	0.0	1.9	2.3	2.5	2.0	1.5
		0%	0%	3%	3%	3%	3%	2%
Average price (incl. pmt)	\$/hl	0.00	0.00	-0.58	-0.77	-0.91	-0.80	-0.62
		0%	0%	-1%	-2%	-2%	-2%	-1%
Surplus Production								
butter exports	000 t	0.00	0.00	8.41	10.15	10.97	8.87	6.56
		0%	0%	54%	91%	96%	65%	41%
powder exports	000 t	0.00	0.00	15.60	18.95	20.49	16.32	12.05
		0%	0%	67%	110%	183%	148%	112%
Processor Returns								
Ice cream milk cost	\$/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0%	0%	0%	0%	0%	0%	0%
Ice cream production	000 t	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0%	0%	0%	0%	0%	0%	0%
Ice cream margin	mil \$	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0%	0%	0%	0%	0%	0%	0%
Skim milk powder production	000 t	-	-	15.6	18.9	20.5	16.3	12.1
		0%	0%	29%	39%	48%	38%	28%
Butter/powder margin	mil \$	0.00	0.00	14.74	18.21	20.07	16.27	12.23
		0%	0%	29%	39%	48%	38%	28%
Consumer Expenditure on Ice cream								
Ice cream consumption	000 t	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0%	0%	0%	0%	0%	0%	0%
Retail price	\$/kg	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0%	0%	0%	0%	0%	0%	0%
Total expenditure	mil \$	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		0%	0%	0%	0%	0%	0%	0%

C. SENSITIVITY ANALYSIS

This section looks at the impacts of varying some of the key assumptions relating to:

- Base blend import level
- Milk production costs
- Pass through of milk cost savings
- Value of butterfat in the blend

1. Sensitivity of Scenarios 1a and 2a to maximum level of blend imports

In this sensitivity analysis, the base case where imports flow in was adjusted to reflect higher levels of imports. Then Scenarios 1a and 2a were rerun to see the impacts on producers, processors and consumers when base imports are more than the 40% level. Table 14 presents the results. In scenario 1a, the effects of blocking the increased imports are generally as expected. The higher the level of imports, the more gain there is to producers from blocking them (at \$32/hl marginal cost) and the more loss to consumers.

In scenario 2a, the sensitivity analysis implies that putting milk for ice cream in a special class is less harmful to producer revenue the higher the potential level of imports. That is, the welfare losses to producers of the special class option are lower if imports are going to rise to 60 or 80% of ice cream requirements than if they rise to only 40%. For consumers, the gain from moving to special class ice cream is lower the higher the potential level of imports.

Table 14: Scenario 1a sensitivity with respect to maximum blend

Figures are change from base due to scenario 1a, under assumption that blends account for 40%, 60%, and 80% of ice cream butterfat ice cream requirements

	1998	1999	2000	2001	2002
Blend Share	Butterfat equivalent of blend imports ('000 tonnes)				
40%	6.9	8.3	9.0	9.1	9.1
60%	8.8	11.8	13.7	13.8	13.8
80%	9.8	13.7	18.3	18.6	18.7
	Change in milk production (mil hl)				
40%	1.8	2.2	2.4	1.8	1.3
60%	2.3	2.8	2.3	1.8	1.3
80%	2.6	2.8	2.3	1.8	1.3
	Change in Producer revenue (mil \$)				
40%	64	78	84	71	60
60%	83	105	101	88	76
80%	92	112	118	104	93
	Change in Producer surplus (mil \$)				
40%	7	8	8	12	17
60%	9	14	26	30	35
80%	10	21	44	48	53
	Change in Consumer surplus (mil \$)				
40%	-18	-23	-24	-26	-26
60%	-23	-32	-33	-39	-38
80%	-26	-37	-38	-52	-51
	Change in Ice cream processor revenue (mil \$)				
40%	-7	-9	-10	-11	-11
60%	-9	-13	-14	-17	-16
80%	-11	-15	-16	-22	-22
	Change in butter/powder processor revenue (mil \$)				
40%	15	19	21	17	13
60%	20	25	21	18	14
80%	22	25	22	18	14

Table 14 (cont): Scenario 2a sensitivity with respect to maximum blend imports

Figures are change from base due to scenario 2a, under assumption that blends account for 40%, 60%, and 80% of ice cream butterfat ice cream requirements

	1998	1999	2000	2001	2002
Blend Share	Butterfat equivalent of blend imports ('000 tonnes)				
40%	6.9	8.3	9.0	9.1	9.1
60%	8.8	11.8	13.7	13.8	13.8
80%	9.8	13.7	18.3	18.6	18.7
	Change in milk production (mil hl)				
40%	2.4	2.8	3.1	2.6	2.1
60%	2.9	3.5	3.1	2.6	2.1
80%	3.2	3.5	3.1	2.6	2.1
	Change in Producer revenue (mil \$)				
40%	-9	-2	-7	-29	-45
60%	9	25	10	-12	-28
80%	18	31	27	5	-11
	Change in Producer surplus (mil \$)				
40%	-86	-93	-106	-113	-113
60%	-84	-87	-89	-95	-95
80%	-83	-80	-70	-77	-77
	Change in Consumer surplus (mil \$)				
40%	85	90	104	113	120
60%	79	79	92	97	104
80%	76	73	85	81	88
	Change in Ice cream processor revenue (mil \$)				
40%	19	23	25	21	17
60%	32	32	38	40	43
80%	31	30	35	34	37
	Change in butter/powder processor revenue (mil \$)				
40%	18	22	24	21	17
60%	22	28	25	22	18
80%	25	28	26	22	18

2. Sensitivity of Scenarios to producer cost assumption in welfare calculations

As discussed, the underlying cost of milk production used in the welfare analyses affects the producer surplus results. This sensitivity analysis presents producer welfare calculations under three alternative cost assumptions: \$22/hl (the Class 5e price), \$32/hl and \$42/hl. The wide range of these assumptions illustrates the uncertainty regarding this variable. Table 15 presents the results.

Table 15: Scenario 1a and 2a sensitivity with respect to marginal cost of milk

Welfare Calculations, Producer Marginal cost = \$22/hl

	1998	1999	2000	2001	2002
Scenario 1a					
consumer surplus	-17.85	-22.66	-23.85	-26.18	-25.74
producer surplus	24.71	30.03	31.66	30.36	30.66
Net change	6.86	7.37	7.81	4.18	4.92
Scenario 2a					
consumer surplus	85.25	89.76	103.65	113.00	120.00
producer surplus	-62.05	-64.82	-75.39	-86.59	-91.38
Net change	23.20	24.94	28.26	26.41	28.61

Welfare Calculations, Producer Marginal cost = \$32/hl

	1998	1999	2000	2001	2002
Scenario 1a					
consumer surplus	-17.85	-22.66	-23.85	-26.18	-25.74
producer surplus	6.74	8.24	8.03	11.91	17.37
Net change	-11.12	-14.42	-15.81	-14.26	-8.37
Scenario 2a					
consumer surplus	85.25	89.76	103.65	113.00	120.00
producer surplus	-86.16	-93.18	-106.32	-112.85	-112.67
Net change	-0.91	-3.42	-2.67	0.15	7.33

Welfare Calculations, Producer Marginal cost = \$42/hl

	1998	1999	2000	2001	2002
Scenario 1a					
consumer surplus	-17.85	-22.66	-23.85	-26.18	-25.74
producer surplus	-11.24	-13.55	-15.59	-6.53	4.08
Net change	-29.09	-36.21	-39.44	-32.71	-21.67
Scenario 2a					
consumer surplus	85.25	89.76	103.65	113.00	120.00
producer surplus	-110.27	-121.54	-137.25	-139.12	-133.95
Net change	-25.02	-31.78	-33.60	-26.12	-13.96

For both Scenarios 1a and 2a, higher cost of milk production implies lower producer surplus. Or, in other words, the lower are producer costs of production, the higher are the gains from blocking imports and the lower are the losses from putting milk for ice cream into a special class.

3. Sensitivity of the analysis to the pass through of milk cost changes

Scenario 1a involves an increase in milk costs to processors, while scenario 2a involves a decrease. Some may argue that processors and/or retailers would be more likely to pass on a milk cost increase than a milk cost decrease. This sensitivity analysis looks at the effects on scenario 2a if only half of the milk cost savings gets passed on to consumers. Welfare calculations are presented in table 16.

Since the retail price does not drop as much as if savings were passed completely through, consumption does not increase as much. This leads to a smaller increase in MSQ than in scenario 2a. Consumer welfare gains are about 50% lower than if costs are passed completely through and producer welfare losses are slightly higher. This table does not show processor or retailer welfare, but the gains there would be similar to the change in consumer surplus between this scenario and scenario 2a (i.e. about \$50 mil), but lower because of the lower production levels. I.e. in this case, the gains from the scenario are shared between consumers and retailers and/or processors.

Table 16: Welfare impacts of Scenario 2a when only 50% of cost savings are passed on to consumers

		1998	1999	2000	2001	2002
consumer surplus	mil \$	40.14	42.20	48.36	52.50	55.62
producer surplus	mil \$	-85.52	-92.39	-104.98	-111.00	-110.64
Total	mil \$	-45.38	-50.19	-56.62	-58.50	-55.03

4. Sensitivity of Scenario 2a to value of butterfat in the blend

As discussed, another method for determining the value of butterfat in the blend imports is to take the blend import price and subtract the international sugar price. This yields a value of butterfat of about \$3.40/kg instead of \$2.90/kg as used in the above analysis. Table 17 presents the impacts of Scenario 2a and 2b, using the higher blend value in the base and for determining Class 5i prices. While the impact of these scenarios on producer net income is still negative, the higher 5i price reduces the negative impact considerably.

Table 17: Sensitivity to higher value of butterfat in blend

Results are change from base when blend butterfat is valued at \$3.40 instead of \$2.90

		1998	1999	2000	2001	2002
Scenario 2a						
Change in producer revenue	mil \$	7.9	14.6	8.5	-13.0	-28.2
consumer surplus	mil \$	68.83	75.01	89.07	99.07	105.63
producer surplus	mil \$	-66.03	-73.32	-87.08	-93.70	-93.03
Net change	mil \$	2.80	1.69	1.99	5.37	12.61
Scenario 2b						
Change in producer revenue	mil \$	35.0	46.7	48.0	33.9	24.1
consumer surplus	mil \$	29.88	29.00	32.18	31.81	30.77
producer surplus	mil \$	-31.64	-32.79	-37.30	-34.93	-27.83
Net change	mil \$	-1.76	-3.79	-5.12	-3.11	2.94

5. Possibilities for further analysis

As requested by the CITT, this paper has examined three main scenarios covering possible government and/or industry reaction to the increased blend imports. In the course of the analysis, other possible industry reactions have been identified including:

- increasing the skim-off requirement for ice cream processors
- general reduction in the target price to increase consumption of all dairy products
- increasing the class prices for other commodities to offset losses in ice cream returns when ice cream is placed in a special class.
- moving milk for ice cream to a special class and removing import protection on ice cream, thereby allowing Canadian ice cream processors the possibility of being competitive in world markets and possibly exporting the product.

These scenarios have not been examined in this study. Other areas where this analysis could be improved are in the modeling and measurement of impacts at the processor and retail levels, including estimates of historical pass through rates.

D. CONCLUSIONS

First general conclusions given the basic assumptions of the analysis are given. Then some of the conclusions falling out of sensitivity analysis are presented.

The following general conclusions follow from the results presented above:

- Scenario 1a is the best of those examined from a producer perspective. Scenario 2a leads to the largest loss in producer surplus.
- From an ice cream processor perspective, scenario 2a is preferred since it expands ice cream production the most.
- Butter/powder processors increase production under all scenarios; Scenario 2a is slightly preferred.
- From a consumer perspective, scenario 2a is also preferred as it increases consumer surplus the most.
- Overall, Scenario 2a appears to have the largest net positive effect (smallest net negative effect) when all stakeholders are taken into account.

Additional conclusions arising from sensitivity analysis:

- It seems possible that butteroil imports would rise to more than 40% of ice cream butterfat requirements. Higher potential imports increases the positive effects on milk production if imports were replaced, but do not necessarily have the same impact on producer net revenues. Higher potential imports increases the negative effect on consumers and processors if the imports are blocked. In scenarios where a special class for ice cream is created, the higher base imports mean the loss to producers is not as great from creating the special class.
- It is difficult to determine the underlying costs of production for a supply managed industry since they are not observed in the market. Sensitivity analysis on this point shows that the lower milk producer's marginal costs are, the higher the benefits to them from blocking imports. Higher marginal costs can lead to scenario 1a having a negative effect on producer welfare. If milk for ice cream is placed in a lower priced special class, again the lower the marginal cost of milk production, the higher the benefits (lower the loss) to producers.
- After the industry is past the MSQ crossover, total producer revenue increase from blocking imports is lower, but the net revenue effect is greater.
- Effects on consumption and ice cream processors would be different if milk cost changes are not passed fully on to consumers. Scenarios 1a and 1b involve an increase in milk costs to processors while Scenarios 2a and 2b involve a milk cost decrease. If milk cost savings were not completely passed on in Scenario 2a, consumer welfare increase would be less while processor or retailer welfare would increase. The overall welfare increase from scenario 2a would be lowered.

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Appendix 1: FARM model dairy component

This appendix is divided into three components

- A. FARM dairy component overview
- B. Selected model validation
- C. Selected data series documentation

A. FARM dairy component overview

Figure A1 presents a flow chart for the FARM dairy component. Changes in the target price for milk are determined using a cost of production formula. This in turn determines changes in the support prices for butter and skim milk powder and in the various class component prices for milk. Wholesale prices run off milk prices and a margin related to wages and other variables. Retail prices run off wholesale prices.

Per capita consumption of various dairy products are a function of retail prices and income. Total consumption is per capita consumption multiplied by population. Total MSQ and fluid milk production levels are set to equal total consumption, adjusted for skim off and exports and imports. Production of each dairy product except for butter and powder is set equal to consumption, adjusted for trade. Butter and powder production and exports are determined residually by taking total butterfat and solids non-fat supplied and subtracting the use in all other dairy products.

B. Selected model validation: estimates of butterfat and solids non-fat requirements

Because dairy policy has been changing, it is difficult to provide comprehensive validation of the latest model structure. This section discusses the model's ability to account for the supply and disposition of milk, and to estimate domestic requirements. The model estimates Canadian milk requirements by taking total consumption less imports, multiplied by average product composition. Prior to 1995/96 dairy year, a 4% "export sleeve" was also added in. From 1995/96 on, the export sleeve is incorporated in Class 5d.

Figure A2 compares the model estimate of butterfat requirements with the actual level of requirements as estimated by the CDC for that period. It shows that the model's method of summing up the component demands closely matches the CDC estimate of actual requirements. MSQ is estimated in advance of the period and so may over or underestimate true requirements.

Figure A1: OVERVIEW OF THE DAIRY MODEL

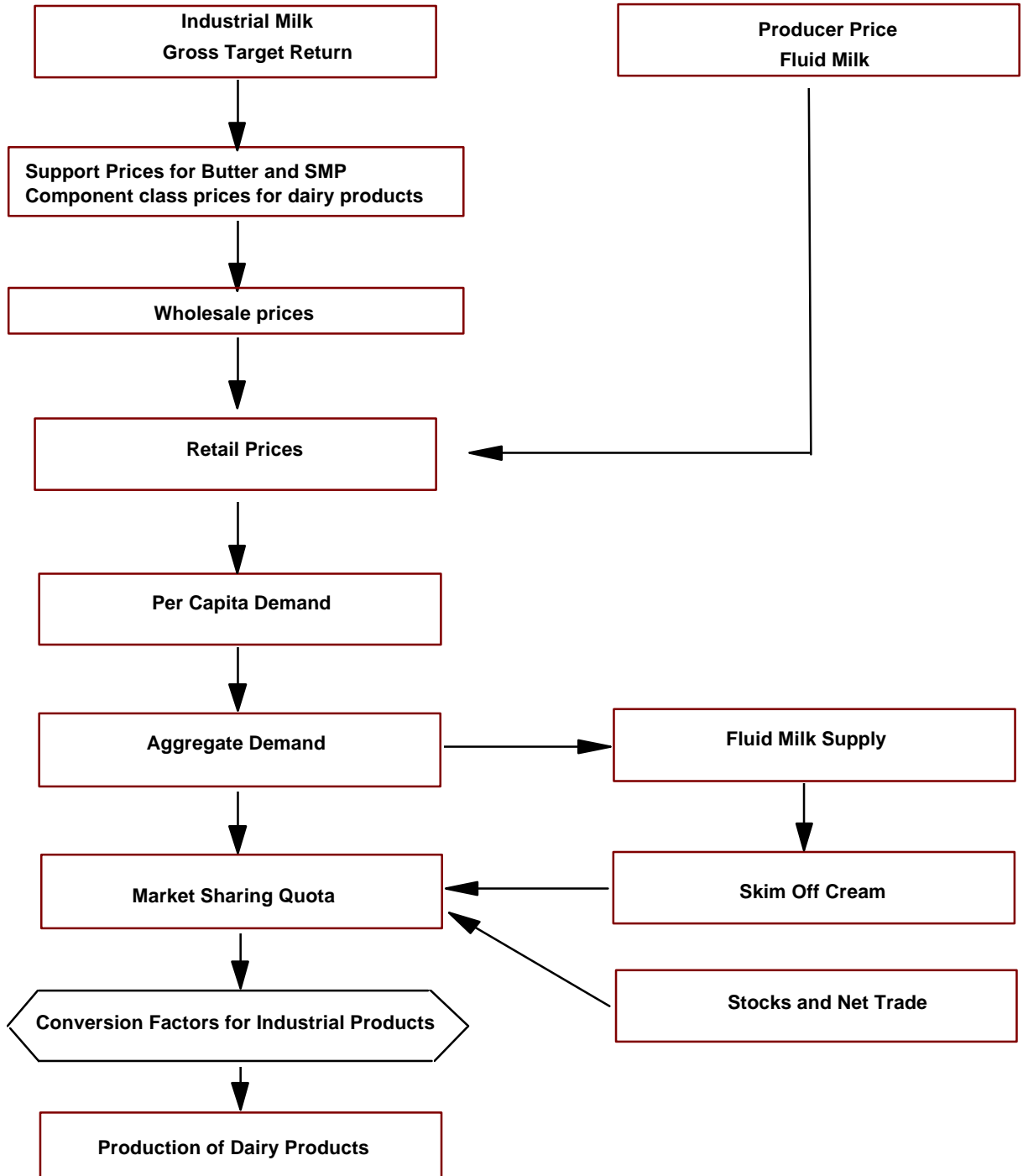
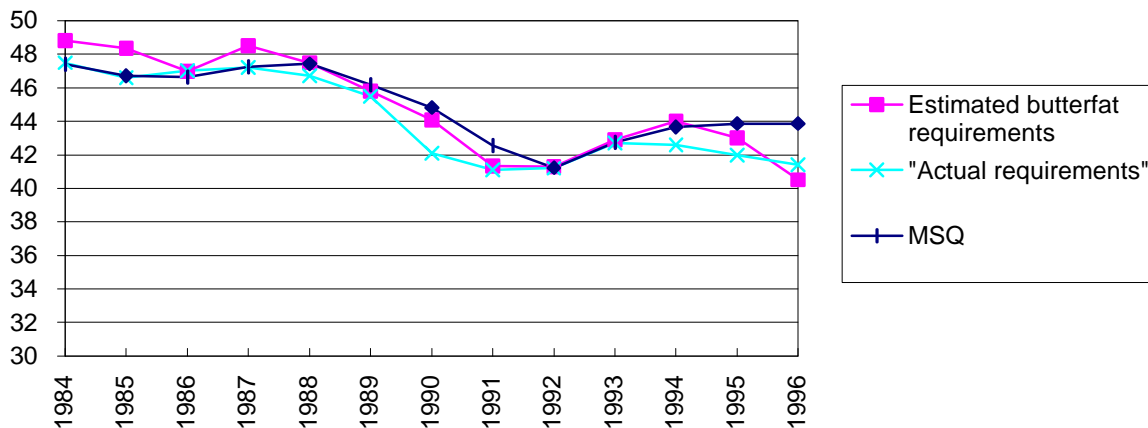


Figure A2: Domestic requirements for butterfat (mil hl)



The model also sums up solids non-fat requirements for Canada. Since no historical series of actual solids non-fat requirements is published, we cannot validate this part. Model estimates show that solids non-fat requirements are increasing whereas butterfat requirements have fallen. It is expected that under current pricing systems, and with continuing blend imports, solids non-fat requirements will overtake butterfat within the next five years.

C. Selected data documentation

Much of the data in the model has been documented in Cozzarin (1991) and Ewing (1994). This section describes some of the data pertinent to this analysis. All data is on a dairy year basis.

Ice cream production

The FARM model definition of ice cream sums up production of ice cream mix, milkshake mix, sherbert and ice milk mix (Statistics Canada CANSIM database numbers D231259, D231311, D231312, and D231314, respectively). Ice cream mix accounts for over 80% of this aggregate. The four components are converted to kg from litres using 1.1 kg/l, 1.1kg/l, 0.8kg/l and 0.7 kg/l respectively. The ice cream aggregate is assumed to contain 10% butterfat and 10.5% solids non-fat by weight.

Ice cream: Cost of milk ingredients, wholesale and retail prices and margins

The Competitiveness Analysis Centre Inc., in a 1995 study, Ice Cream Benchmarking Study, found that the cost of milk ingredients in Canada ranged from \$0.73 to \$1.28 per kg of ice cream, with an average of \$0.93 per kg. In FARM, milk ingredients to ice cream are

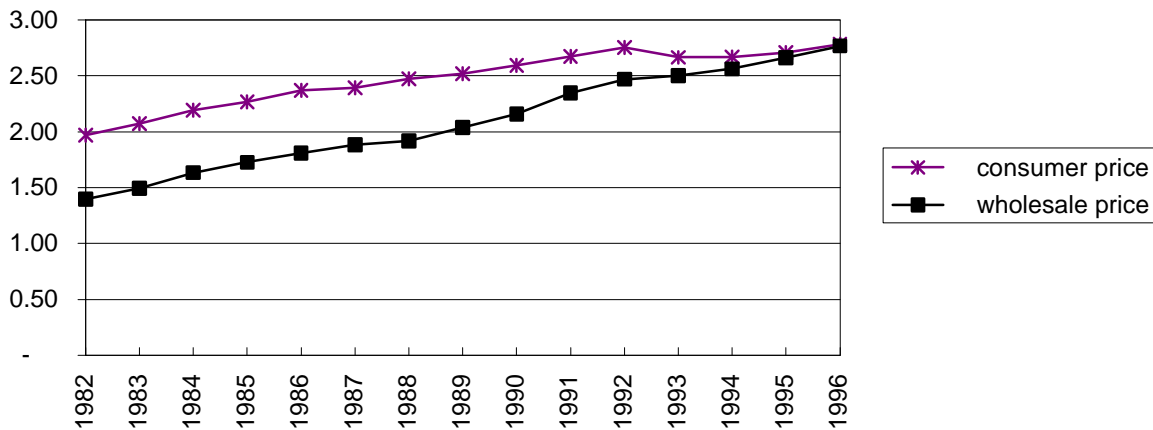
estimated to cost a bit more: \$0.97 in 1996 using a 10% butterfat, 10% solids non-fat formula and Class 2 milk ingredient prices

Where no direct source of time series data on wholesale prices is available, FARM computes wholesale prices by taking per unit value of shipments from the Census of Manufacturer's data and applying it to a Industrial Product Price Index for the product. For ice cream, this leads to a wholesale price of \$2.77/kg in 1996. The Ice Cream Benchmarking Study found that the total cost of ice cream processing averaged about \$1.84/kg in 1992 which is much lower than the FARM value of \$2.47/kg for that year.

Retail prices in FARM are calculated in a similar manner to wholesale prices: time series are constructed using unit values from the Family Food Expenditure Survey and the consumer price index series for the product in question. For ice cream this leads to a retail price of \$2.78/kg (\$4.98/litre) in 1996.

Figure A3 shows the wholesale and retail prices for FARM over time. The data suggests that the retail margin has shrunk considerably in the last five years. It also suggests that there may be some problem in the data series (in particular, given the evidence from the benchmarking study cited above, it appears that the wholesale price for ice cream may be too high).

Figure A3: Wholesale and retail ice cream prices in FARM (\$/kg)



This problem should not affect the analysis of the blend issue much, as long as the consumer price is at an appropriate level, since all milk ingredient cost changes are passed completely through and the only consumption impact is at the consumer level.

Class prices

Special class prices and volumes are available beginning in 1995/96. Class 1 to 4 prices are available for Ontario beginning in 1996/97. Ontario prices are used as a proxy for average Canadian price.

The FARM dairy variables have been priced using the different class prices of milk as follows:

- a. Class 1A - whole milk, low-fat milk
- b. Class 1B - fluid creams
- c. Class 2 - ice cream & yogurt minus exports
- d. Class 3A - specialty cheese, cottage cheese minus exports minus class 5a
- e. Class 3B - cheddar cheese minus exports
- f. Class 4A - butter, skim milk powder, other dairy products (whey butter, buttermilk powder, whole milk powder) minus exports minus class 5b minus class 5c
- g. Class 4B - evaporated milks minus exports
- h. Class 5A - held constant at recent observed levels; subtracted from class 3A
- i. Class 5B - held constant at recent observed levels; subtracted from class 4A
- j. Class 5C - held constant at recent observed levels; subtracted from class 4A
- k. Class 5D - cheese, evaporated milk and other dairy product exports
- l. Class 5E - butter and skim milk powder exports

Appendix 2: Calculation of maximum volume of butterfat/sugar blend imports and of unit value for the imports

A. Maximum Volume of Blend Imports

Table A1 reports the historical data available on the blend imports. Volumes have increased and the source of imports switched from the US and EU to New Zealand and Mexico between 1996 and 1997.

Table A1: Imports of Butteroil/Sugar Blends

year	volume (kg)	value (\$)	\$/kg
1995	1,348,691		2.33
		3,136,236	
1996	3,794,293		2.35
		8,898,206	
1997	8,603,599		2.18
		18,762,854	
Source of 1996 imports			
	volume (kg)	value (\$)	\$/kg
US	3,129,695		2.36
		7,392,769	
EU	529,937		2.21
		1,171,443	
Mexico	115,160		2.57
		295,393	
NZ	19,500		1.98
		38,600	
Source of 1997 imports			
	volume (kg)	value (\$)	\$/kg
NZ	4,025,800		2.04
		8,223,069	
Mexico	2,786,517		2.29
		6,393,997	
EU	1,376,210		2.26
		3,115,008	
US	418,073		2.29
		956,129	

Dairy scientist Professor Doug Goff from University of Guelph suggests that, from a technical and food quality point of view, blend imports could be used to supply 100% of ice cream butterfat requirements. However, Ontario has a rule requiring that 50% of ice cream butterfat requirements come from skim-off cream. Since Ontario accounts for about 40% of the ice cream produced in Canada, this rule means 20% of the butterfat requirements would not be imported. In addition, most experts indicate that the “super premium brands” would not use the blend as an input. These brands accounted for only about 1.1% of the market in 1994 according to Nielsen data purchased by AAFC in 1995, although that share had grown

from 0.5% in 1989. Another factor to consider is that producer owned processing cooperatives may not purchase the blend; it has been suggested that some cooperatives have rules explicitly forbidding the use of the blend.

Thus, to a large extent, the future use of blends depends on the skim-off rule and the use of blends by cooperatives. There may be pressure from ice cream processors affected by these rules to allow further use of the blend since they must compete with processors who are using it. Or, ice cream manufacturing may move to areas or companies not affected by the rules to gain the cost advantage of the blends. If this were true, it implies that, over time, the majority of ice cream would be produced using the butterfat sugar blend.

As a starting point, this analysis took existing estimates that blend imports could supply up to 40% of the butterfat in ice cream. However, since it seems possible that imports could be significantly higher than this amount, sensitivity analysis examined the implications for results if blend imports were 60% or 80%.

B. Unit cost of the blend and the value of butterfat in the blend

Table A1 above shows that the source of imports switched from the US and EU to New Zealand and Mexico between 1996 and 1997. The table also shows that the per unit value of blends imported from New Zealand is about 20% cheaper than the other sources with a unit import value of C\$2.00 per kg instead of C\$2.50. Ice cream processors have indicated they are saving \$1/kg on the butterfat they buy in the blend.

It is assumed that the value of butterfat in the blend is equivalent to the “world price of butterfat” (FOB N. Europe butter price, divided by .816), about \$2.90/kg in 1997. When the domestic cost of butterfat is \$5.49/kg, this means the savings to processors appear to be about \$2.60/kg butterfat, higher than processors indicated. This calculation does not allow for distribution from port to processor which would likely raise the price somewhat. . Note that using the world prices for sugar and butter lead to an implicit margin on the blend of \$0.13/kg in 1996, rising to \$0.27/kg in 1997 and later years. Table A2 details the calculations.

Table A2: Detailed Calculations for value of butteroil blend

		1996	1997	1998	1999	2000	2001	2002
Blend import price (from NZ, dairy year)	C\$/kg	1.98	2.04	2.00	1.94	1.83	1.79	1.83
World sugar price (FOB London, dairy year)	C\$/kg	0.50	0.48	0.47	0.49	0.47	0.46	0.45
World butteroil price (FOB N Europe, dairy year)	C\$/kg	2.92	2.81	2.75	2.63	2.48	2.43	2.49
51% sugar/49% butter blend + 9.5% tariff	C\$/kg	1.84	1.77	1.74	1.69	1.59	1.56	1.59
implied margin	C\$/kg	0.13	0.27	0.26	0.25	0.24	0.24	0.24
Savings over class 2 butterfat @ \$5.49/kg	C\$/kg	2.57	2.68	2.74	2.86	3.01	3.06	3.00

Another method for calculating the value of the butterfat in the blend has been suggested: take the import cost of the blend and subtract the value of the sugar component. This leads to a higher butterfat value. Using this method, a blend import price of \$2.50/kg,

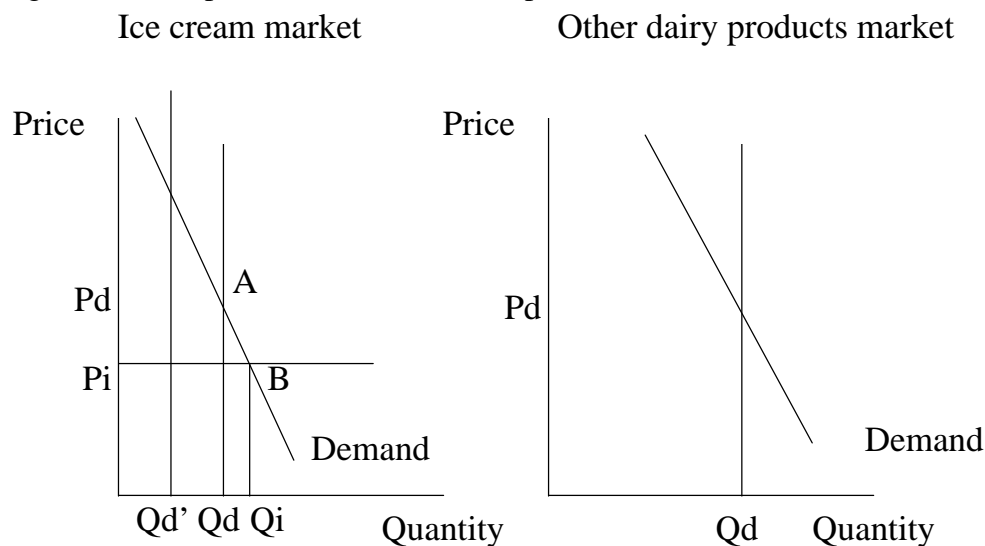
and a world sugar price of \$0.50/kg implies the value of butterfat in the blend is about \$4.50/kg which is more consistent with the \$1/kg savings indicated by processors.

There is some reason to believe that initially blend suppliers could charge a higher price for the butterfat, but over time one would expect that international competition to supply the market would drive down the value to the world butterfat value.

Appendix 3: Welfare Calculations

Figure A4 presents a simplified economic model of the issues facing the supply managed industry in this analysis. This is the framework used to calculate the consumer and producer surplus estimates reported in the results.

Figure A4: Simplified model of blend import issue



In the base case, the main impact of the imports is in the ice cream market where domestic production is replaced by the imports. Domestic production shifts from Q_d to Q_d' while domestic consumption increases from Q_d to Q_i . The level of imports is $Q_i - Q_d'$. The rest of the dairy sector is not affected in this simple case.

The simple case is complicated by a number of factors including:

- imports are of butterfat only
- milk production and the use of milk ingredients in ice cream is of the joint products, butterfat and solids non-fat
- components are price differently depending on their use
- butterfat and solids non-fat are not used in equally in Canadian dairy - one or the other is in surplus
- processing and retailing sector are abstracted from in this case

The FARM model analysis provides changes in producer and consumer prices and quantities due to different scenarios. Using these changes, welfare changes are calculated as follows:

- The change in consumer welfare due to a scenario is estimated as the change in price multiplied by the average of the initial and final quantity (Area PdABPi in figure A4).
- The change in producer surplus is calculated as the change in total revenue less marginal cost times change in production ($(Q_d - Q_d') * P_d - \text{cost} * (Q_d - Q_d')$ in figure A4). Where 'cost' is the per unit cost of the additional milk production.

The cost of additional milk production is a crucial variable in this analysis. Under free market conditions, any additional production would be undertaken only by the lowest-cost producers if the offered price exceeds their marginal costs of production. There are grounds to believe that this cost is at or below the over-quota return, since there are some producers who voluntarily exceed their quotas and produce at that price. However, in the situations examined here, any additional production is proportionally shared by all producers who hold production quota. This suggests that the relevant cost is the average marginal cost of all dairy producers. This is certainly higher than the marginal costs of the most efficient, but it cannot be directly observed. The main results reported in table 2 are based on the assumption that this cost is \$32/hl and alternative scenarios with higher and lower costs are reported in Section C.

For processors and retailers, the assumption of complete pass through means that technically the change in welfare is zero due to different scenarios. However, if cost changes are not completely passed through, or if margins vary with the level of production or sales, then processor and/or retailer welfare could be affected by the scenarios.