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Report 6

A Qualitative Assessment of the Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans in the Dairy Sector

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On-Farm Food Safety and Environmental Farm Plans: Identifying and Classifying Benefits and Costs

Canada

A Qualitative Assessment of the Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans in the Dairy Sector

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More information on the On-Farm Food Safety and Environmental Farm Plans series is available on the Internet at **www.agr.gc.ca/spb/rad-dra**.

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Foreword

As consumers become more sophisticated and discerning in their food purchases, Canadian agriculture and agri-food production is changing to meet the challenge. Supply chains have been formed that specifically address food safety, food quality, and environmental concerns. Even the farm gate is reassessing the way it does business. Industry initiatives are looking at the feasibility, and in many instances are already in the process, of implementing on-farm food safety programs (OFFS) and environmental farm plans (EFP). The Agricultural Policy Framework (APF) recognizes the importance of food safety and environmental concerns for the future growth of the agriculture and agri-food sector. For this purpose, Agriculture and Agri-Food Canada (AAFC) has commissioned a series of six reports to develop a conceptual framework to strengthen our understanding of the benefit and cost implications OFFS and EFP will have across the agri-food chain[1]. The conceptual framework provides a systematic approach for organizing and pulling together stakeholders and government ongoing work in determining how best to implement on-farm food safety and environmental planning. The reports also provide preliminary qualitative applications of the conceptual framework to the Canadian pork, beef, grain and dairy sectors.

This sixth report in the series "*On-Farm Food Safety and Environmental Farm Plans: Identifying and Classifying Benefits and Costs*" details the assessment for the Canadian dairy sector

The full list of reports in the series "On-Farm Food Safety and Environmental Farm Plans: Identifying and Classifying Benefits and Costs" is as follows:

Report 1: *Overview of the Development and Applications of a Conceptual Framework for Analyzing Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans* by J.E. Hobbs, J-P. Gervais, R. Gray, W.A. Kerr, B. Larue and C. Wasylyniuk

Report 2: *On-Farm Food Safety and Environmental Farm Plans: A Conceptual Framework for Identifying and Classifying Benefits and Costs* by J.E. Hobbs, J-P. Gervais, R. Gray, W.A. Kerr and B. Larue

1. *The bulk of the analysis for this study was completed in March 2003, prior to the discovery of bovine spongiform encephalopathy (BSE) in a single beef cow in Alberta, and the subsequent closure of the U.S. and other countries' borders to all Canadian live ruminant and ruminant meat and meat product exports.*

Report 3: *A Qualitative Assessment of the Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans in the Pork Sector* by B. Larue, J-P. Gervais, J.E. Hobbs, W.A. Kerr, and R. Gray

Report 4: *A Qualitative Assessment of the Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans in the Beef Sector* by W.A. Kerr, C. Wasylyniuk, J.E. Hobbs, J-P. Gervais, R. Gray and B. Larue

Report 5: *A Qualitative Assessment of the Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans in the Grain Sector* by R. Gray, M. Ferguson, B. Martin, J.E. Hobbs, W.A. Kerr, B. Larue and J-P. Gervais

Report 6: *A Qualitative Assessment of the Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans in the Dairy Sector* by J-P. Gervais, B. Larue, J.E. Hobbs, W.A. Kerr and R. Gray

Executive summary

This report deals with the potential benefits and costs associated with OFFS and EFP in the Canadian dairy sector. The on-farm food safety initiative in the dairy industry is the Canadian Quality Milk program (CQM). The objective of the program is to give consumers proof that their dairy products meet well-defined food safety standards. The CQM incorporates best farm management practices with an emphasis on communication and effective record keeping.

OFFS provide two types of benefits to dairy producers: 1) they provide insurance against food safety scares; and 2) they can increase profits if they trigger positive changes in consumers' preferences and/or cost efficiencies that are accompanied by proportional movements in prices and quantities.

An environmental farm planning initiative was launched by the Ontario Farm Animal Council, the Dairy Farmers of Ontario and the Ontario Farm Environmental Coalition (OFEC). Ontario EFP have been developed by farmers with financial support from AAFC. EFP are documents that are voluntarily prepared by farmers designed to raise their awareness of the environmental implications of their activities. Their purpose is to facilitate the identification of environmental concerns and set goals to improve environmental conditions.

The analysis in this report describes the on-farm food safety and environmental initiatives currently in operation in the dairy industry. Potential benefits and costs for producers, processors and consumers are identified. Food safety concerns in the dairy industry are not of the same magnitude as in other agri-food sectors because of the quality controls already in place (e.g. the quality of the milk delivered from a truck is checked before it can be processed) and because of the pasteurization process. The dairy industry is also different from other sectors in terms of its production and marketing regulations. In this sector, the farm price and the level of production is determined exogenously by regulators and imports are controlled by very restrictive tariff-rate quotas. These elements have been taken into consideration in the analysis of shocks caused by OFFS initiatives. Given that the farm price and the level of milk produced may not respond to increases or decreases in cost efficiencies on the farm, adjustments are likely to be limited to changes in quota values. Under price and output rigidities, the benefits of increased consumer confidence stemming from publicity regarding on-farm food safety initiatives could be shared by processors and consumers, leaving producers empty-handed.

As for food safety concerns, there seems to be less of a sense of urgency in addressing environmental concerns in the dairy industry than in other sectors such as the pork sector. In spite of that, a significant effort is still being devoted to promote the design and implementation of voluntary EFP by dairy farmers. There is the potential for an overlap between food safety and environmental initiatives in the dairy sector. Such overlaps should be accounted for in the documentation and implementation of these initiatives to minimize complaints from time-stressed farmers.

Chapter 1

Introduction

Food safety, food quality and environmental concerns have become issues in the domestic and export markets for many Canadian agri-food products. A large number of industry-led and public sector initiatives are attempting to respond to these rising concerns. While these initiatives can be solely reactive, it is hoped that the changes being put in place can improve the competitive advantage of individual Canadian agri-food industries and the Canadian agri-food industry as a whole. Besides the positive effect on profitability, there may be other benefits that accrue to society from initiatives that enhance food safety and improve the environmental sustainability of agricultural production.

The APF, endorsed by the Government of Canada and most provincial governments, stresses food safety and environmental stewardship as among the top priorities for guaranteeing a strong future for Canadian agriculture. The APF considers the implementation of Hazard Analysis Critical Control Point (HACCP)-like OFFS and the implementation of EFP vital in ensuring Canada continues to be a world leader in the agri-food industry.

This is the sixth report in a series dealing with the assessment of potential benefits and costs associated with proposed OFFS and EFP initiatives for Canadian agriculture. The objective of this sixth report is to provide a broad preliminary assessment for the Canadian dairy sector. An analysis of regional differences in on-farm food safety and environmental initiatives is made. The analysis focuses on the Quebec and Ontario dairy industries.

This report is structured in four chapters. The remainder of this section outlines the benefit-cost framework developed and used in this research project. Chapter 2 provides some background about on-farm food safety in the dairy sector, presenting relevant information on dairy production patterns, and identifying key benefits and costs of OFFS. Chapter 3 discusses EFP in the dairy industry. Conclusions are provided in Chapter 4. Appendix A contains a technical analysis. A glossary of key technical terms and a list of abbreviations is provided in Appendix B.

1.1 The benefit-cost framework[2]

Any proposed change in the way a firm, or an industry, operates needs to be assessed before a decision can be made regarding its desirability. It does not matter if this change arises in response to an opportunity identified by the firm's management, from a change in market conditions (such as a recession) or a change in the regulatory environment within which the firm operates. If the proposed change is determined to be detrimental to a firm's profits, then alternatives can be explored or a decision made to exit from the industry. Assessments may be straightforward and as simple as "back of the envelope" calculations. In many cases, however, there may be a large number of factors that enter into the assessment of a proposed change and a more formal structure is needed to organize those factors to ensure completeness and to allow positive and negative factors to be weighed. Often the interaction among factors is complex, making it impossible to arrive at a correct assessment through informal means. One of the most long-standing and thoroughly developed aids to formal decision-making is benefit-cost analysis, and it has been employed in this study.

The benefit-cost approach has a number of advantages for decision-making in complex situations. It can be undertaken with differing degrees of sophistication and rigour. Typically, the use of the benefit-cost framework starts with a relatively simple exercise that catalogues the various expected outcomes that may arise from a proposed change in the way firms or industries operate. Outcomes are sorted into benefits and costs. This catalogue is typically very broad and not all of the listed outcomes may be applicable to each firm or industry. This broad approach is undertaken to ensure completeness.

Once the catalogue is complete, the next stage surveys those who work in the firm(s) to assess the importance of each possible outcome. This allows the important benefits and costs to be identified so that further efforts can be concentrated on the key decision variables. In many cases, once this stage is reached no further analysis is required because the broad outlines of the decision are obvious.

If the result is not clear, the use of the framework can be deepened to increase the transparency of the decision. If necessary, monetary values of key benefits and costs can be obtained. This is often expensive requiring sophisticated estimation techniques and specialised professionals. There is a clear research resources question regarding the value of improving the information pertaining to decision-making relative to the costs of obtaining the information. The important point, however, is that the consistent framework is capable of organizing increasingly sophisticated pieces of information.

Since many of the changes in the way firms or industries operate will have outcomes that span considerable periods of time, and costs may incur at different times than benefits are received, more formal benefit-cost procedures can incorporate discounting techniques. If the investment is made to obtain complete quantification of key outcomes, the discounting techniques allow comparison of the monetary benefits and costs over time, and hence determination of the dollar value of the net benefit. As many assumptions are typically needed to calculate the quantitative benefit and cost estimates, the decision-maker can also measure the sensitivity of his/her net benefit calculation to these assumptions.

2. *The Conceptual framework presented in this section is a summary of Report #2. It is presented here for the convenience of the reader. For additional information on the conceptual model, the reader is referred to the report "On-Farm Food Safety and Environmental Farm Plans: A Conceptual Framework for Identifying and Classifying Benefits and Costs" (Hobbs et al., 2003).*

This report used a benefit-cost framework to assess OFFS and EFP. The catalogue of benefits and costs was first developed. Next, the experience of industry with already existing on farm quality control and environmental enhancement systems was used to identify the key benefits and costs. No attempt was made to deepen the analysis through the acquisition or development of quantitative measures, as this would have required far greater resources than were available. The framework provides a template upon which a formal quantitative analysis can be based. Considerable insights, however, can be gleaned from the qualitative analysis presented.

Benefit-cost analysis has one additional advantage as an aid to decision making. Private and societal benefits and costs often diverge (i.e. the costs imposed on society from water polluted by agricultural production do not show up on the financial balance sheet of the farm causing the pollution; nor do the benefits urban dwellers receive from farmers undertaking soil conservation practices that reduce dust storms). Thus, a proposed change in the way firms operate may lead to differences in the desirability of the outcome depending upon whether the private or public view is taken. Benefit-cost analysis allows both private and public benefits and costs to be incorporated into the decision-making framework in a consistent fashion. Through a comparison of the two decisions it is possible to assess the desirability of public sector intervention to encourage or dissuade private sector decisions.

Some of the costs of OFFS are obvious. There will be start-up (fixed) management costs associated with developing a plan and putting it into operation, including one-time costs associated with changes to facilities (fixed capital costs associated with compliance). There will also be ongoing (variable) management and compliance costs associated with operating the system, extra wage costs or possibly additional personnel, on-going staff training, computer equipment, updates of record keeping software, etc. Other costs may not be so obvious. If systems are not mandatory, there may be costs associated with segregating products that are produced under OFFS from those that are not, so that consumers can be assured of the quality of the products they are consuming. Whether products have been produced under OFFS protocols cannot be discerned when food is purchased or even after consumption. As a result, there must be ways of verifying that the products have been produced to this standard. Thus, there will be costs associated with monitoring production processes. There will also be costs associated with dealing with those who cheat or lack the skills to live up to their commitments.

A wide range of potential benefits have also been incorporated into the framework to evaluate OFFS. These benefits tend to be less obvious than the costs; and better illustrate the importance of using a formal framework. For example, in times of rising international concerns regarding food safety, having an OFFS in place may enhance access to foreign markets. It may also allow Canadian products to be differentiated from other products in foreign markets and allow Canadian producers to obtain a premium for their product. It may also enhance the reputation of Canadian food internationally, assisting in building a loyal base of international customers.

An OFFS can benefit consumers by reducing the costs they must incur to learn about the safety of the food they purchase. It may also benefit producers by reducing the expenditures they must make to build consumer confidence in their products, or in production through improvements in the use of inputs or an increased output (e.g. through the reduction in product condemnations or recalls). Benefits may also accrue along the supply chain, such as lower losses during transportation and less post-farm monitoring.

One of the major benefits may be the reduced liability cost arising from the ability to trace products through the supply chain when there is a break down in the food safety system. Being able to identify the farm(s) of origin may reduce the number of farms whose products must be

recalled and may also increase the speed with which an animal health problem or crop contamination problem can be dealt with. There may also be benefits that arise from isolating any firms currently free-riding on the food safety system (e.g. a farmer who feels he/she doesn't have to reduce his/her pesticide use because all the other farmers will and no one will notice his/her high pesticide levels if everything is mixed at the grain elevator).

Many of these benefit and cost scenarios can be couched in an insurance framework whereby incurring the costs associated with OFFS acts not to eliminate a future occurrence but rather to reduce the probability that a future occurrence takes place. As some food safety problems can greatly reduce the income of a large number of farmers (e.g. a foot-and-mouth outbreak), each farmer's contribution to increased food safety acts as an insurance premium to reduce the probability of a high cost future event that affects a large number of farmers.

The benefit-cost framework for EFP is similar to that for OFFS. On the cost side there are both fixed and variable costs associated with establishing and implementing a plan. There are also monitoring and enforcement costs in terms of ensuring that plans are actually being followed and to discipline those who breach their commitments.

If the farm plan indicates that there are unacceptable environmental practices taking place in the farming operation, there may be mitigation costs associated with remedying the problem. These may be capital costs such as the installation of more sophisticated manure handling systems or variable costs such as changes to feed rations to reduce phosphorous in faecal material. As with OFFS, there may be costs associated with segregating products produced under EFP from products not produced under such plans.

Benefits from EFP arise from lowering information costs relating to the environmental friendliness of the processes used to produce food and simultaneously increasing consumer confidence in the food system. There may be benefits from being able to brand Canadian products as environmentally friendly and from reducing the costs of meeting the market access requirements of importing countries. Farmers may benefit from enhanced self-worth and community status from increasing their environmental stewardship. Putting production on an environmentally sustainable basis will increase the quality of life for Canadians and may result in reduced human health impacts from toxic spills, etc. Externalities and liabilities pertaining to air quality and odour (nuisance) problems may be reduced. There could also be positive ecosystem effects such as enhanced wildlife habitat and green house gas reductions.

Again, some of the benefit and cost scenarios can be couched in insurance terms – as cost premiums to reduce the probability of infrequent and catastrophic events. The framework can also be adapted to deal with the long-time horizons that characterize some environmental benefits.

In addition to cataloguing the benefits and costs of HACCP-based OFFS and EFP, the distributional effects of the changes to various actors along the supply chain have been examined. For example, to reap a private sector benefit from the HACCP-based OFFS will require changes to how agricultural products are monitored along the supply chain to the final consumer. The firms that participate in the supply chain will have to incur costs in ensuring that the high food standards are maintained through the supply chain and that consumers are ultimately informed of the benefits they receive. Supply chain participants may also have a chance to share in any increase in revenues that arise from the change. Where appropriate, the factors that influence how these benefits and costs are shared among supply chain participants are identified.

Individual sectors will have differences in benefits and costs depending upon factors such as whether the industry is heavily involved in exporting and whether their products are currently branded. Where appropriate, these differences are pointed out and their effect on the efficacy of food safety and EFP initiatives are indicated.

Chapter 2

On-farm food safety initiatives in the dairy industry

2.1 Introduction

At the outset, it is important to provide a brief history of how food safety initiatives in the Canadian dairy industry began. The Canadian On-Farm Food Safety program (COFFS) was started in 1997. It is administered by the Canadian Federation of Agriculture. The four phases of the program are:

1. *Establishment of a national strategy to adopt an OFFS.*
2. *Development of a generic HACCP model, production of producer materials, running pilot projects, developing auditor training materials.*
3. *Implementation of the program through producer awareness and training sessions, auditor training, on-farm audits, development of certification system.*
4. *Official recognition of the program by the Canadian Food Inspection Agency (CFIA), a third party audit and an administrative assessment.*

The dairy industry is currently in the fourth stage of the COFFS and as such, the food safety initiative is not yet completed.

The on-farm food safety initiative of the dairy industry is the Canadian Quality Milk (CQM) program. It was developed and introduced recently under the coordination of the Dairy Farmers of Canada (DFC) with the introduction of a reference manual in 2001 and with CFIA's recognition and approval in 2003. The objective is to give consumers proof that their dairy products meet well-defined food safety standards. The CQM incorporates best management practices (BMPs) with an emphasis on communication and effective record keeping on the farm. The approach of the CQM is four-pronged and combines: i) BMP ii) a HACCP approach, iii) critical control points within HACCP, and iv) standard operating procedures (SOPs).

To obtain a CQM validation, a farm must demonstrate that it meets or exceeds a number of performance criteria. The producer must be currently licensed to ship milk by the provincial regulatory authority. The producer must also meet minimum acceptable standards set out in the National Dairy Regulations Code and the dairy regulations of his/her province. The producer must monitor the five mandatory critical control points through the use of permanent records, BMPs and documented SOPs. The five mandatory critical points are: i) prevention of residues in milk and meat, ii) milk cooling and storage, iii) milking equipment cleanliness, iv) water safety, and v) livestock medicine injections.

BMPs are recommended procedures that integrate the principles and goals of: i) food safety and quality, ii) production efficiency, iii) implementation practicality, iv) profitability, and v) environmental quality. SOPs constitute the first step in applying BMPs in a consistent manner. The Dairy Farmers of Ontario (DFO) encourages the development of documented SOPs for all key aspects of milking operations on farms. Moreover, the HACCP program supported by dairy producers: i) makes a livestock medicine course mandatory, requires producers to provide proper storage for livestock medicine, and requires producers to keep both permanent and temporary records, ii) calls for installing time temperature recorders to monitor both bulk tank temperatures and wash and rinse temperatures in the milk-line, and iii) calls for taking and testing water samples regularly.

The CQM is currently voluntary. Dairy producer representatives have set modest goals with regards to the enrolment rate into CQM. For example, the fédération des producteurs de lait du Québec (FPLQ) hopes to convince 200 dairy producers (about 3%) to adopt the CQM in the near future.

2.2 *The dairy industry*

Before presenting the benefits and costs of CQM for the dairy industry, production and trade data for the two largest dairy producing provinces, Quebec and Ontario, are described. This information provides some context within which to understand the potential impact of OFFS. Table 1 presents the total hectolitres of milk produced in Canada, Quebec and Ontario from 1998 to 2001. The table reveals a small decline in Canadian milk production from 1998 to 2001. While production has remained relatively constant in Ontario and in other western provinces, production in Quebec has declined by 6%.

Table 1: Milk production in hectolitres

	1998	1999	2000	2001
Canada	74,543,915	73,897,706	72,799,359	72,826,237
Quebec	28,304,247	27,487,978	27,139,266	26,658,240
Ontario	25,121,750	25,333,342	24,961,480	25,127,751
Other provinces	21,117,918	21,076,386	20,698,613	21,040,246

Source: Agriculture and Agri-food Canada.

Figure 1 presents the evolution of the number of dairy farms in Canada, Quebec and Ontario. In Canada, the number of dairy farms has fallen from 32,678 in 1991 to 19,411 in 2001; a decrease of 68%. The decrease in the number of farms in Ontario and Quebec has followed the national trend although it has not been quite as spectacular. The number of dairy farms in Quebec decreased from 14,043 in 1991 to 9,248 in 2001; a decrease of 52%. In Ontario, the number of dairy farms decreased from 10,549 in 1991 to 6,468 in 2001; a decrease of 63%.

Figures 2, 3 and 4 illustrate the evolution of production and trade of Canadian dairy products from 1991 to 2001. Figure 2 shows that there has been a significant increase in the production of yogurt. Yogurt production almost doubled between 1991 and 2001; increasing from 83 to 151 thousands metric tonnes. In contrast, production of other dairy products has been more stable. In terms of trade, Figure 3 illustrates that imports of dairy products have been relatively stable between 1991 and 2001. This is due to the severe trade restrictions put in place to protect the Canadian dairy industry from import competition. The 1995 World Trade Organization (WTO) Agreement on Agriculture has not triggered a surge in imports (with the exception of butter) mainly because of Canada's bilateral agreement with the U.S. under the North American Free Trade Agreement (NAFTA). Imports of butter have skyrocketed since 1995 and reached a peak of

Figure 1:
Number of dairy farms from 1991 to 2001

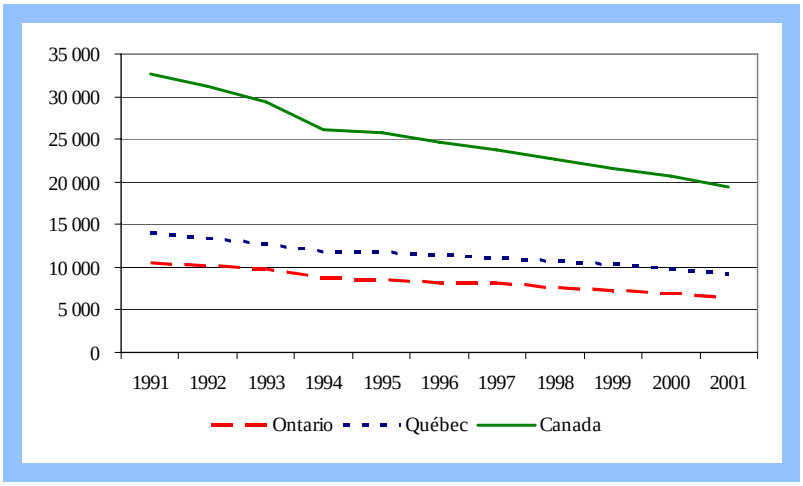


Figure 2:
Production of dairy products

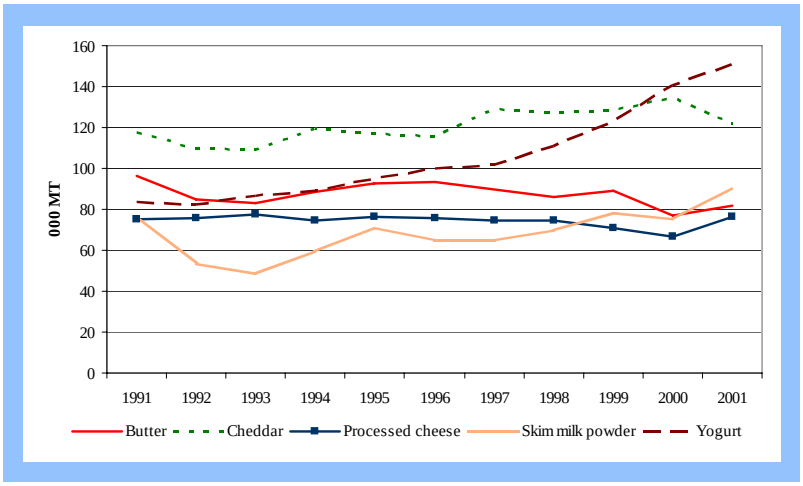
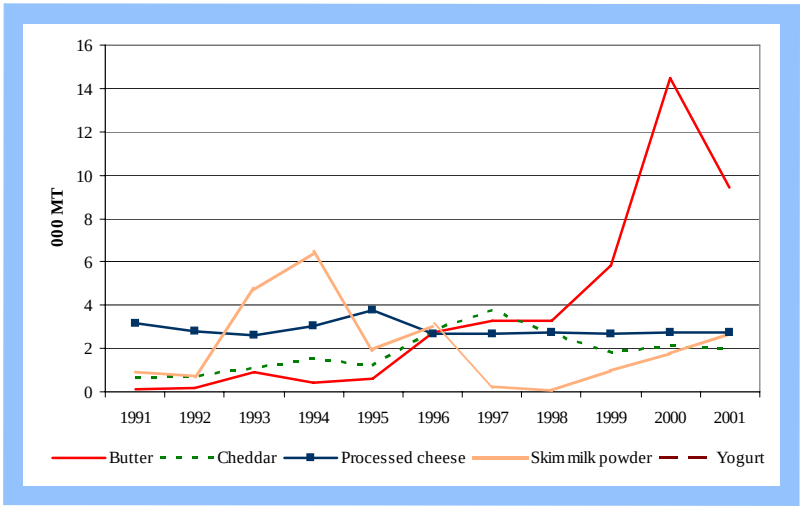


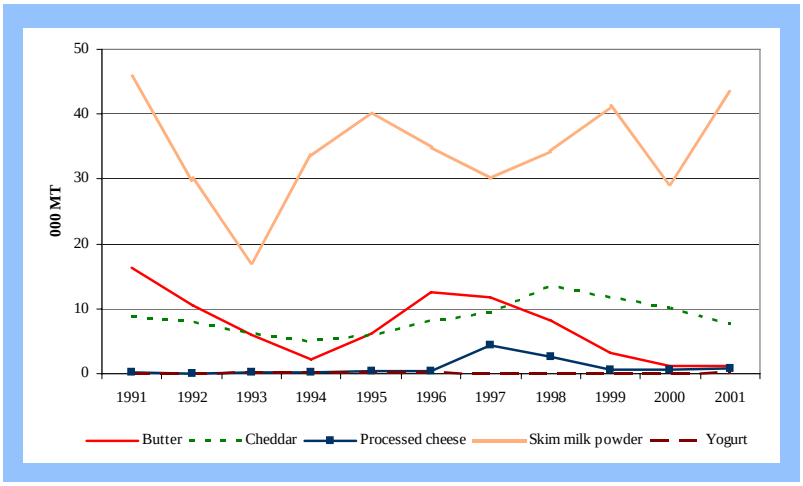
Figure 3:
Imports of dairy products



Source: Agriculture and Agri-Food Canada.

14.1 thousands tonnes in 2000. In large part because of its supply management policy, Canada is not a major exporter of dairy products. Exports of butter have steadily decreased since 1995. Although exports of skim milk powder were extremely volatile over the period 1991-2001, they still account for the largest share of Canada's aggregated dairy exports. Exports of cheddar and processed cheese and yogurt have been relatively stable during the last ten years.

Figure 4:
Exports of dairy products



Source: Agriculture and Agri-Food Canada.

From the previous description, it is easy to identify facts about the dairy industry that could impact the flow of benefits and costs of implementing on-farm food safety initiatives. Historically, Canada has never been a major exporter of dairy products. This trend is not likely to be reversed in light of the last WTO decision over the complaint lodged by the U.S. and New Zealand regarding Canada's dairy export marketing mechanisms. Canada has abandoned its Commercial Export Milk program (CEM) and its level of exports must fall within the commitments made under the WTO Agreement of Agriculture. Accordingly, any food safety initiative in the dairy sector must target domestic food safety issues. Dairy producers are worried that additional food safety requirements at the farm level could contribute to the changing structure of dairy farms, as it is feared that larger farms are better equipped to cope with initiatives put in place to address environmental and animal welfare issues. Many producers are concerned about the amount of record keeping required if the CQM were to become mandatory.

2.2 *Benefit-cost analysis*

Table 2 presents the potential benefits of the OFFS in dairy production based on the classification of potential demand-side benefits identified in Report #2 (Hobbs et al., 2003a). Table 3 presents the potential benefits of quality assurance and food safety programs in dairy production based on the classification of potential supply-side benefits. Finally, Table 4 presents the potential supply-side costs associated with implementing an OFFS.

Table 2: Potential private demand-side benefits of on-farm food safety in dairy production

DEMAND-SIDE BENEFITS	DESCRIPTION
Domestic market:	
Reduce transaction costs for consumers	Consumers' confidence in dairy products is believed to be relatively high due to the treatment of milk prior to commercialization (i.e. pasteurization). Premiums for producers are not likely to emerge from a food safety initiative at the farm level. In any case, milk prices at the farm level are regulated and any change in the pricing of raw milk would likely require extensive negotiations between producers, processors and the Canadian Dairy Commission

Table 2: Potential private demand-side benefits of on-farm food safety in dairy production (Continued)

Build consumer confidence	Can HACCP-based measures help reduce sales loss in the case of milk contamination incidents? If consumers' perception of quality depends on the information obtained or received about the quality of milk and dairy products, then pro-active programs such as the CQM should help reduce potential sales losses in the aftermath of a bacterial contamination (e.g. pesticide heptachlor contamination in Hawaii detailed in Smith et al., (1988)) Producers and processors in Quebec are currently in the process of negotiating a monetary premium relative to the decrease of total bacteria contained in milk shipments. The CQM could make it easier for producers to secure such premiums. Premiums would likely decrease in time with CQM adoption rate, yielding greater benefits for early adopters
<u>International markets:</u>	
Provide differentiation on the international market	The future of Canadian dairy exports is rather gloomy. Exports of specialty products (e.g. cheese) and other niche dairy products may benefit from an OFFS initiative when dealing with food safety-concerned importers
Reinforce and develop trade networks	Trade networks are not likely to be further developed due to Canada's export subsidization commitment at the WTO
Facilitate trade by reducing non-tariff barriers	

Table 3: Potential private supply-side benefits of on-farm food safety in dairy production

SUPPLY-SIDE BENEFITS	DESCRIPTION
<u>Efficiency gains at the farm level</u>:	
Improve productivity of inputs	Training sessions to implement the CQM and the mandatory documentation of SOPs should enhance the overall management ability of producers. Inputs are likely to be used more efficiently and this could lead to lower production costs. This can also increase the over-all productivity of dairy operations at the farm level
<u>Efficiency gains in business relationships between producers, processors and retailers</u>:	Reduces expected losses in the event of a serious (contamination) incident but may not change the odds in court cases
Reduce logistical costs	Improves the guarantee of a quality-consistent supply of milk to processors and consumers. However, thorough quality controls are already in place to prevent the processing of tainted milk. Producers face substantial penalties if their milk does not meet stringent quality conditions related to bacteria and somatic cell count. The dairy industry has for a long time emphasized the achievement of performance standards
Ex-post cost reduction following detection of contaminant in food	
Reduce measurement costs: performance versus process standards	
Reduce monitoring and enforcement costs	
Reduce product liability costs	

Table 4: Potential private costs of on-farm food safety in dairy production

SUPPLY-SIDE COSTS	DESCRIPTION
Management and compliance costs	The structure of dairy farms is important. The number of dairy farms has been continuously declining over the past decade Variable costs include filling out the paperwork to document good production practices Fixed costs may include modifications to the buildings or other fixed investments to comply with the CQM guidelines. Some producers may have to make more adjustments in terms of fixed costs than others that have relatively recent dairy farm installations. This is impossible to address without surveying farms Fixed costs are: 1) installation of a thermometer (that continuously tracks and records bulk tank temperature and costing approximately $1500 2) Bi-annual water safety tests costing approximately $100 per test

Table 5 summarizes the potential benefits and costs associated with the implementation of various OFFS approaches in the dairy industry. The table is a qualitative assessment based on interviews with industry stakeholders.

Table 5: Benefits and costs of alternative OFFS systems for the dairy industry

	Voluntary industry-wide OFFS	Enforced industry-wide OFFS	Buyer specific OFFS	Regulatory standards
Benefits				
Reduce transaction costs for consumers	Minimal	None	Minimal	Minimal
Build consumer confidence	Minimal	Minimal	Minimal	Moderate
Convey additional information	Minimal	Minimal	Minimal	Minimal
Provide differentiation on international markets	None	None	Minimal	None
Facilitate trade by reducing NTBs	None	None	None	None
Reinforce and develop trade networks	None	None	None	None
Improve productivity of inputs	Minimal	Minimal	Minimal	Minimal
Improve efficiency in production	Minimal	Minimal	Minimal	Minimal
Reduce logistic costs	Minimal	Minimal	None	Minimal
Reduce measurement costs: performance versus process standards	None	None	None	Minimal
Reduce monitoring and enforcement costs	Minimal	Minimal	Minimal	Minimal
Reduce product liability costs	Minimal	Minimal	Minimal	Minimal
Reduce ex-post cost following contamination	Minimal	Minimal	Minimal	None
Reduce free-rider impacts	None	None	None	None
Reduce incidence of foodborne illness	None	Minimal	Minimal	Minimal
Reduce information asymmetry	None	None	None	None
Total benefits	Minimal	Minimal	Minimal	Minimal

Table 5: Benefits and costs of alternative OFFS systems for the dairy industry (Continued)

	Voluntary industry-wide OFFS	Enforced industry-wide OFFS	Buyer specific OFFS	Regulatory standards
Costs				
Management costs				
fixed – establishing the HACCP plan	Significant	Significant	Moderate	Moderate
variable – revising plan to reflect external changes	Significant	Significant	Minimal	Moderate
Compliance costs				
fixed – capital costs	Moderate	Significant	Moderate	Moderate
variable	Minimal	Minimal	Moderate	Minimal
Sunk investments				
risk of hold-up	Minimal	Minimal	Significant	None
Monitoring and enforcement costs				
fixed	Minimal	Minimal	Minimal	Moderate
variable	Moderate	Significant	Moderate	Moderate
Total costs	Moderate	Significant	Significant	Moderate
TOTAL NET BENEFITS	Moderate cost	Moderate cost	Moderate cost	Moderate cost

2.3 *Modeling the effects of OFFS*

The objective of this section is to illustrate the potential effects of on-farm food safety initiatives on equilibrium quantities and prices in the dairy industry. A detailed explanation of the technical model is presented in Appendix A of this report. A general presentation of the technical analysis is presented in the conceptual framework report (Hobbs et al., 2003a). The analysis is presented for different scenarios of the demand and supply side benefits and costs listed in the previous section. The technical analysis accounts for particular features of the Canadian dairy industry such as supply management. It is also hypothesized that Canada is a small importing country of dairy products. There exists a tariff-rate quota (TRQ) that effectively shields the domestic market from imports. A TRQ is a two-tiered tariff which applies a low tax rate to a (small) 'in-quota' volume of imports and a higher rate to imports in excess of the in-quota volume.

As the OFFS affects the costs of supplying milk and the demand for milk, a central question is what happens to the farm price which is the primary concern of the supply management policy. Any producer benefit related to efficiency gains in production could be completely offset by an equivalent decrease in the regulated farm price. In such a case, all of the benefits would accrue to consumers. Because the dairy sector is highly regulated, the farm price and production level are pre-determined variables, and as such it is extremely difficult to anticipate the effects of OFFS on the choices made by regulators. Accordingly, it is assumed that the farm price and domestic production remain constant.[3]

3. *One should note that movements in the marginal cost curves of producers and processors and/or changes in consumers' preferences for dairy products could easily affect the predetermined variables of the model, but it is beyond the scope of this study to analyze such impacts.*

A number of scenarios are examined.

Scenario 1: The analysis begins by investigating a hypothetical OFFS-induced increase in production costs. This scenario assumes that efficiency benefits are outweighed by the additional costs that must be incurred to implement on-farm food safety quality controls on the farm. As discussed earlier, the farm price and production levels are constant. The only impact at the farm level is on the quota value. There are no effects at the processing level. A decrease in production or an increase in the farm price (due to higher production costs) could potentially restore the quota value to its initial value. An OFFS initiative could also result in cost reduction. It turns out that cost efficiencies lowering the marginal cost of milk production would be capitalized into higher quota values.

Scenario 2: Consider a situation in which processors' marginal cost decreases due to the implementation of OFFS initiatives. This could be caused for example by efficiency gains in logistics or by fewer product recalls. Due to the sticky farm price assumption and the constant supply controls, processors internalize the gain from the food safety initiative at the farm level. Producers do not enjoy immediate benefits from their effort. This example illustrates vividly the rigid constraints imposed by dairy regulations on the distribution of benefits following the implementation of on-farm food safety initiatives.

Scenario 3: Consider an increase in the demand for dairy products due to an increase in consumers' confidence for dairy products following the implementation of the OFFS. The effect of this increased demand by Canadian consumers is contingent upon the choices made by regulators. Under the assumption that the farm price and output of dairy producers remain constant, the demand-enhancing shock would bring about a higher retail price that would benefit processors. Hence, the regulators must allow for increases in the producers' output and/or the farm price of raw milk if producers are to enjoy monetary benefits from adopting food safety measures.

On-farm food safety initiatives provide two types of benefits to dairy producers: 1) they provide insurance against food safety scares and 2) they can increase profits if they trigger positive changes in consumers' preferences and/or cost efficiencies that are accompanied by proportional movements in prices and quantities. The impacts of the latter type of benefits are directly constrained by supply management and trade policies.

Chapter 3

Environmental farm plans in the dairy industry

Environmental initiatives at the farm level have only taken place at provincial levels so far, although the federal government has been involved in the planning phase of various programs. The best known environmental initiative at the farm level is the one promoted by the Ontario Farm Animal Council, The Dairy Farmers of Ontario and the Ontario Farm Environmental Coalition (OFEC). Ontario EFP have been developed by farmers with the financial support of AAFC. EFP are documents that are voluntarily prepared by farmers. They are designed to raise the farmers' awareness about the environmental implications of agricultural activities. Their ultimate purpose is to facilitate the identification of environmental concerns and to set goals to improve environmental conditions[4].

Participation in an EFP is voluntary and requires the completion of five steps: i) attend an EFP workshop ii) complete an environmental self-assessment iii) develop an action plan iv) participate in a confidential review and v) implement the EFP action plan. Following the attendance of the workshop, a producer needs to review the way he/she uses the land and the buildings and the products on the farm according to the 23 worksheet instructions. Some worksheet instructions particularly apply to dairy producers while others are not relevant.

It is important to emphasize that there exists some complementarities between OFFS and EFP, although the cross-effects among programs are thought to be relatively insignificant from a producer's perspective. There are also similarities and overlaps between the EFP and the CQM documentation. For example, the milking centre washwater worksheet of the EFP and the BMPs related to water and feed in the CQM present overlapping instructions and guidelines in the daily operations that produce washwater as a by-product from the milking centre. If washwater is not carefully managed, it can contaminate both ground water and surface water. Another example of complementarities includes the manure use and management guidelines of the EFP

4. *Further discussion of EFP in the livestock sector can be found in Report #4: "A Qualitative Assessment of the Benefits and Costs of On-Farm Food Safety and Environmental Farm Plans in the Beef Sector" (Kerr et al, 2003).*

worksheet and the BMPs related to dairy facilities and manure management in the CQM. Overlaps in practice descriptions or records should be identified whenever possible to convey to farmers that promoters of food safety and environmental initiatives are aware of the high opportunity cost of a farmer's time.

3.1 Benefit-cost analysis

Table 6 presents the potential benefits of EFP in dairy production based on the classification of potential demand-side and supply-side benefits identified in Report #2 (Hobbs et al., 2003a). Table 7 presents the potential supply-side costs associated with implementing EFP.

Table 6: Potential private benefits of environmental farm plans in dairy production

DEMAND-SIDE BENEFITS	DESCRIPTION
Domestic market:	
Reduce transaction costs for consumers Build consumer confidence	EFP may provide increased consumer confidence for some consumers sensitive to environmental issues and thus result in increased demand for some dairy products. However, producers do not believe that EFP will increase farm prices or market shares in the dairy sector
International markets:	
Provide differentiation on the international market Reinforce and develop trade networks	The future of Canadian dairy exports is rather gloomy and EFP should not impact the small export market shares of dairy specialty products Trade networks are not likely to be further developed due to Canada's export subsidization commitments at the WTO
SUPPLY-SIDE BENEFITS	**DESCRIPTION**
Efficiency gains at the farm level:	EFP are unlikely to have effects on efficiency
Reduce monitoring and enforcement costs	Monitoring costs are likely to be impacted although the direction of the changes in costs cannot be identified with certainty at this time Enforcement costs will be reduced in the event of prosecution or litigation because of the "due diligence" defense

Table 7: Potential private costs of environmental farm plans in dairy production

SUPPLY-SIDE COSTS	DESCRIPTION
Management and compliance costs	There are significant management costs for initially designing the plan. Another fixed cost includes the audit cost of the Ontario Environmental Farm Plan, which requires an initial audit but not continuous, random audits Significant variable costs are incurred to comply with land use regulations. This includes manure management Fixed costs may include modifications to the buildings or other fixed investments to comply with environmental guidelines. Some producers may have to make more adjustments in terms of fixed costs than others that have relatively recent dairy farm installations and have already implemented environmental protection practices

Table 8 summarizes the potential benefits and costs of environmental farm plans for the dairy industry according to two different institutional schemes. The table is based on a qualitative assessment of benefits and costs from discussions with industry stakeholders.

Table 8: Institutional comparisons of the benefits and costs of EFP for the dairy industry

	Voluntary EFP	Land use regulations
Benefits		
Reduce transaction costs for consumers	None	None
Build consumer confidence	Minimal	None
Convey additional information	None	None
Provide differentiation on international markets	None	None
Facilitate trade by reducing NTBs	None	None
Reinforce and develop trade networks	None	None
Reduce monitoring costs	None	None
Reduce non-pecuniary benefit to producers	None	None
Reduce negative human health	Minimal	Minimal
Reduce negative impact on farm assets	Minimal	Minimal
Improve local ecosystem effects	Minimal	Minimal
Total benefits	None to minimal	None to minimal
Costs		
Planning costs		
fixed – establishing the framework	Moderate	Moderate
variable – revising policy	None	Moderate
Monitoring costs		
fixed	Minimal	Significant
variable	None	Moderate
Mitigation costs		
fixed – capital costs	Minimal	Significant
variable	None	Moderate
Total costs	Minimal	Moderate
TOTAL NET BENEFITS	Miminal cost	Moderate cost

Chapter 4

Conclusion

This case study has described the on-farm food safety and environmental initiatives currently in operation in the dairy industry. Potential benefits and costs for producers, processors and consumers have been identified. Food safety concerns in the dairy industry are not of the same magnitude as in other agri-food sectors because of the quality controls already in place (e.g. the quality of the milk delivered from a truck is checked before it can be processed) and because of the pasteurization process. The dairy industry is also different from other sectors in terms of its production and marketing regulations. In this sector, the farm price and the level of production is determined exogenously by regulators and imports are controlled by very restrictive TRQs. These elements have been internalized in the analysis of shocks caused by on-farm food safety initiatives. Given that the farm price and the level of milk produced need not respond to increases or decreases in cost efficiencies on the farm, adjustments are likely to be limited to changes in quota values. Under price and output rigidities, the benefits of boosted consumer confidence stemming from publicity regarding on-farm food safety initiatives would be shared by processors and consumers, leaving producers empty-handed.

As for food safety concerns, there does not seem to be as great a sense of urgency to address environmental concerns in the dairy industry than in other sectors such as the pork sector. In spite of that, significant effort is being devoted to promote the design and implementation of voluntary EFP by dairy farmers. There appears to be more overlap between food safety and environmental initiatives in the dairy sector than initially believed. Such overlaps should be accounted for in the documentation and implementation of these initiatives to minimize complaints from time-stressed farmers.

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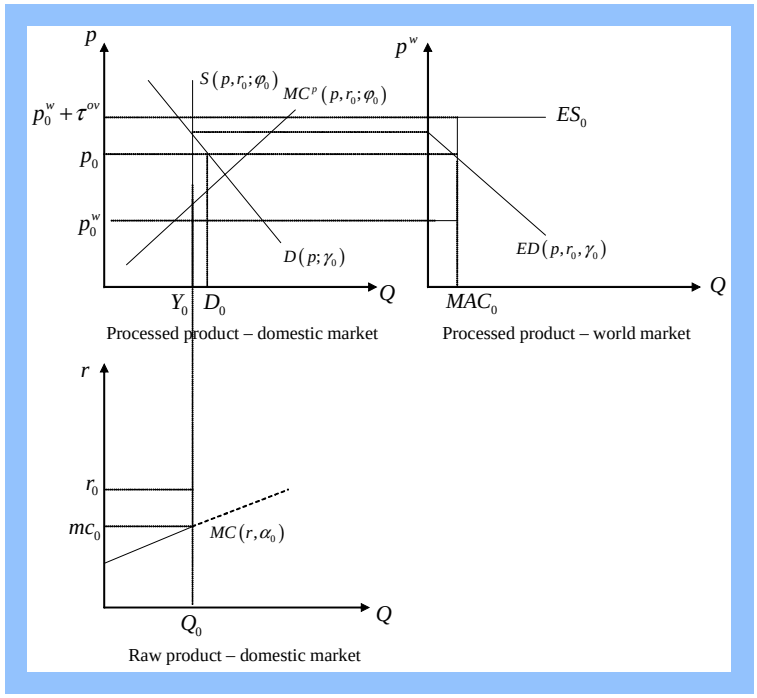
Technical appendix

APPENDIX A

The objective of this section is to illustrate the potential effects of on-farm food safety initiatives on equilibrium quantities and prices in the dairy industry. A more detailed explanation of the technical model is presented in the conceptual framework report (Hobbs et al., 2003a). The analysis is presented for different scenarios of the demand and supply side benefits and costs listed in chapter 2. Figure 5 illustrates the initial market equilibrium. The bottom left diagram depicts the domestic market for raw milk. Supply management constrains the quantity of milk supplied by the industry at Q_0. The farm price is determined by the Canadian Dairy Commission (CDC) and is set (exogenously) at r_0.[5] At the given quantity supplied, the marginal cost for producers is mc_0. The difference between r_0 and mc_0 is defined as the quota value. The upper left panel of Figure 5 represents the dairy retail market in Canada. Consumers' demand for processed dairy products is denoted by $D(p,\gamma_0)$. The marginal cost of processors is represented by the $MC(p,r_0,\varphi_0)$ schedule. The supply of processors is perfectly inelastic since domestic retail production is constrained to be equal to domestic raw milk production.

Figure 5:
Initial market equilibrium



The upper right panel represents the world market for processed dairy products. It is hypothesized that Canada is a small importing country of dairy products. The world price is exogenously fixed at p_0^w. There exists a tariff-rate quota (TRQ) that effectively shields the domestic market from imports. A TRQ is a two-tiered tariff which applies a low tax rate to a (small) 'in-

5. *The farm price is determined exogenously in the model. In reality, the CDC establishes the farm price based on cost of production estimates at the farm level. Given that on-farm food safety initiatives can potentially impact the efficiency of dairy producers and thus influence their cost structure, the price of milk at the farm level could be influenced by on-farm food safety initiatives. In what follows, these considerations are left aside and it is assumed that any cost inefficiencies are reflected in the value of dairy production quotas.*

quota' volume of imports and a higher rate to imports in excess of the in-quota volume. Hence, a TRQ has three components: i) the in-quota or maximum volume of imports upon which the lower tariff is levied, ii) an in-quota tariff and iii) an over-quota tariff. The over-quota tariff is imposed on any imports exceeding the in-quota limit or minimum access commitment (MAC). In reality, there exists a set of 11 different TRQs in the dairy industry.[6] For the purpose of this study, it is assumed that the quantity MAC_0 represents the quota level for the entire dairy processing industry. The over-quota tariff has been purposely set at prohibitive levels (Tangermann, 1996; Larue et al., 1999a,b; Gervais and Surprenant, 2003) and thus it is assumed that the MAC is binding. Given the trade restrictions, the effective export supply curve is composed of the segments forming the step function ES_0. Given the quantity controls on the domestic market and consumers demand for dairy products, the excess retail demand function for dairy products is ED_0. The domestic retail price of dairy products is p_0. This diagram of the retail market assumes away any imperfect competition behaviour at the retail level.[7] Shifters are included in the farm supply function (α), in the domestic retail demand curve (γ) and in the processors' supply function (φ). The shifters can represent a number of effects induced by the implementation of an OFFS. Finally, note that raw milk is not traded in the model.

As the OFFS moves the supply and demand schedules around, a central question is what happens to the farm price. Any producer benefit related to efficiency gains in production could be completely offset by an equivalent decrease in the regulated farm price. In such a case, all of the benefits would accrue to consumers. Because the dairy sector is highly regulated, the farm price and production level are pre-determined variables, and as such it is extremely difficult to anticipate the effects of OFFS on the choices made by regulators. Accordingly, it is assumed that the farm price and domestic production remain constant.[8]

Figure 6:
OFFS-induced changes in production costs

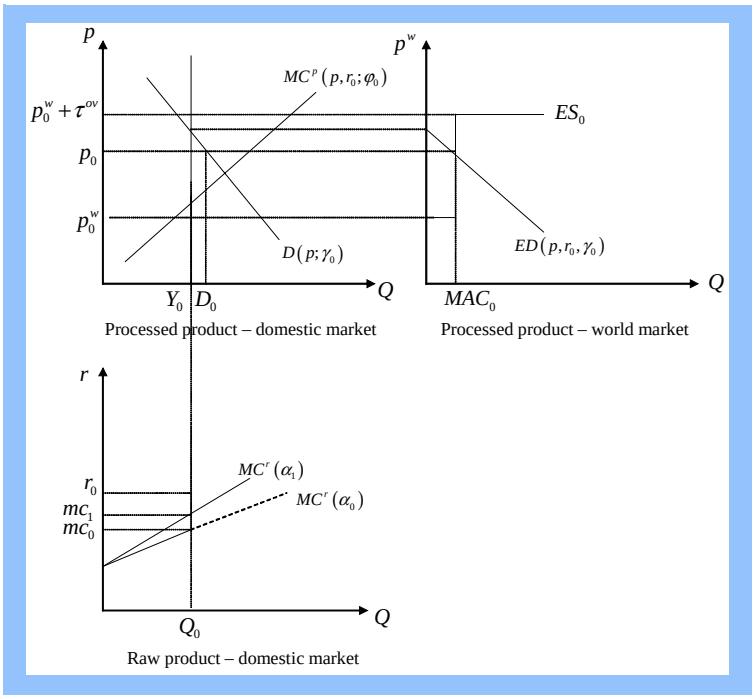


Figure 6 illustrates an upward shift of the producers' marginal cost resulting from an on-farm food safety induced increase in production costs. This scenario assumes that efficiency benefits are outweighed by the additional costs that must be incurred to implement on-farm food safety quality controls on the farm. As discussed earlier, the farm price and production levels are constant. The only impact at the farm

6. *There are TRQ for yogurt, dry whey, heavy cream, concentrated and condensed milk/cream, fluid milk, powdered buttermilk, butter, products of natural milk constituents, cheese, ice cream and other dairy products.*
7. *See Gervais and Rude (2003) for an analysis with an imperfectly competitive processing sector.*
8. *One should note that movements in the marginal cost curves of producers and processors and/or changes in consumers' preferences for dairy products could easily affect the predetermined variables of the model, but it is beyond the scope of this study to analyze such impacts.*

level is on the quota value. It decreases from $r_0 - mc_0$ to $r_0 - mc_1$. There are no effects at the processing level. A decrease in production or an increase in the farm price (due to higher production costs) could potentially restore the quota value to its initial value.

Figure 6 can also be used to infer the effect of an on-farm food safety induced cost reduction. It turns out that cost efficiencies lowering the marginal cost of milk production would be capitalized into higher quota values.

Figure 7 illustrates a decrease in the processors' marginal cost due to the implementation of on-farm food safety initiatives. This could be caused for example by efficiency gains in logistics or by lower product recalls. The increase in processors' surplus is represented by the shaded area in the top-left diagram. Due to the sticky farm price assumption and the constant supply controls, processors internalize the gain from the food safety initiative at the farm level. Producers do not enjoy immediate benefits from their effort. This example illustrates vividly the rigid constraints imposed by dairy regulations on the distribution of benefits following the implementation of on-farm food safety initiatives.

Figure 8 provides an analysis of an increase in the demand for dairy products due to an increase in consumers' confidence for dairy products following the implementation of the OFFS. The effect of this increased demand by Canadian consumers is contingent upon the choices made by regulators. Under the assumption that the farm price and output of dairy producers remain constant, the demand-enhancing shock would bring about a higher retail price that would benefit processors. Imports would be unaffected because of the high over-

Figure 7:
OFFS-induced decrease in processors' costs

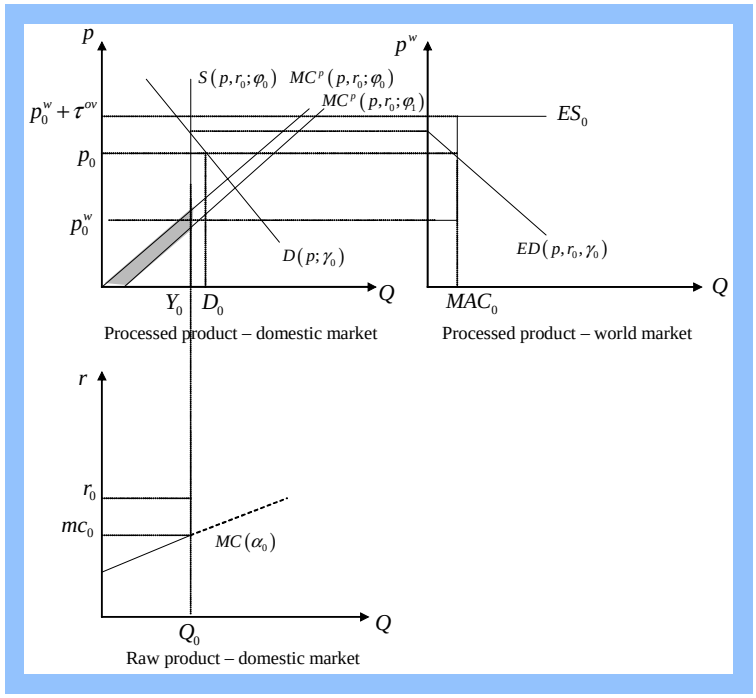
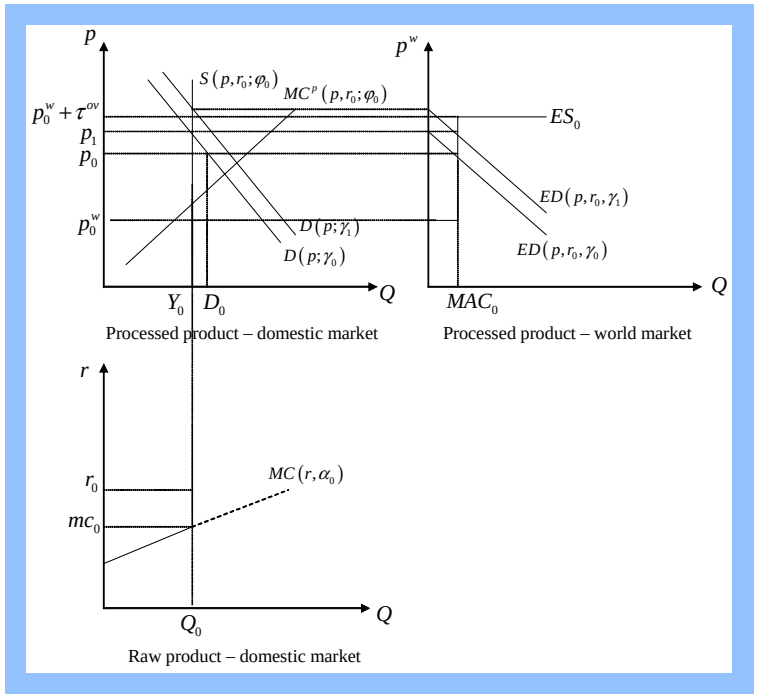


Figure 8:
OFFS-induced increase in demand



quota tax on imports. Hence, the regulators must allow for increases in the producers' output and/or the farm price of raw milk if producers are to enjoy monetary benefits from adopting food safety measures.

In the case of a food safety scare, the demand for dairy products would fall, the retail price would decrease and processors' profits would also be reduced. This would create tensions in the supply managed industry and there would be strong pressures to pass on part of the reduction in the retail price to producers.

On-farm food safety initiatives provide two types of benefits to dairy producers: 1) they provide insurance against food safety scares and 2) they can increase profits if they trigger positive changes in consumers' preferences and/or cost efficiencies that are accompanied by proportional movements in prices and quantities. The impacts of the latter type of benefits are directly constrained by supply management and trade policies.

Glossary of terms and list of abbreviations

APPENDIX B

Glossary

TERMS	DEFINITIONS
Consumer surplus	A measure of the benefits to consumers (buyers) of a market outcome, i.e. the excess of marginal benefit over price
Demand-side effect	A benefit or costs that manifests itself by increasing or decreasing the demand for a product
Economic surplus	The sum of consumer and producer surplus. A measure of the total value to society of a market outcome
Externality	Costs or benefits that flow between economic agents but that are not paid for in the market place
Free-ride	The ability to benefit from something without incurring the costs
Information asymmetry	When one party to a transaction (e.g. the seller) has more information than the other (e.g. the buyer)
Marginal benefit	The additional benefit from producing one more unit of output
Marginal cost	The additional cost of producing one more unit of output
Market benefit/cost	See Private benefit/cost
Market failure	When distortions prevent prices from accurately reflecting the true benefit or cost of a good, leading to a misallocation of resources (see externalities)
Non-market benefit/cost	See Public benefit/cost
Own price elasticity	A measure of the responsiveness of quantity demanded for a product to a change in its price, everything else remaining equal
Perfectly elastic	When own-price elasticity is infinity. A firm can sell all it wants at the going market price but will sell nothing at all other prices
Perfectly inelastic	When own-price elasticity is zero. Quantity demanded is not responsive to changes in price
Private benefit/cost	Benefits and costs for products that bought and sold in the marketplace
Producer surplus	A measure of the total benefits to producers of a market outcome, i.e. the excess of price over marginal cost

TERMS	DEFINITIONS
Public benefit/cost	Benefits and costs that flow between economic agents but that are not paid for in the market place (see externality)
Social benefit/cost	See Public benefit/cost
Social welfare	See economic surplus
Sunk costs/investment	Costs that cannot be recovered
Supply-side effect	A benefit of cost that manifests itself by increasing or decreasing the supply of a product
Tariff rate quota	A two-tiered tariff which applies a low tax rate to a (small) 'in-quota' volume of imports and a higher rate to imports in excess of the in-quota volume
Transaction cost	The cost of carrying out an exchange, including search costs of gathering information, the costs of negotiating the transaction costs, the costs of monitoring product quality or actions of trading partners and the costs of enforcing the terms of the transaction

Abbreviations

APF	Agricultural Policy Framework
BMPs	Best management practices
CDC	Canadian Dairy Commission
CEM	Commercial Export Milk Program
CFIA	Canadian Food Inspection Agency
COFFS	Canadian On-Farm Food Safety program
CQM	Canadian Quality Milk Program
DFC	Dairy Farmers of Canada
DFO	Dairy Farmers of Ontario
EFP	Environmental Farm Plan programs
FPLQ	Fédération des producteurs de lait du Québec
HACCP	Hazard Analysis, Critical Control Points
MAC	Minimum access commitment
NAFTA	North American Free Trade Agreement
OFEC	Ontario Farn Environmental Coalition

OFFS	On-Farm Food Safety programs
SOPs	Standard operating practices
TRQ	Tariff Rate Quota
WTO	World Trade Organisation