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Economic Evaluation Models of Generic Fluid Milk and Cheese Marketing Investment in Canada for the 2007-2011 Period

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Economic Evaluation Models of Generic Fluid Milk and Cheese Marketing Investment in Canada for the 2007-2011 Period

Maurice Doyon[1]*,John Cranfield*[2]

Executive Summary

The Dairy Farmers of Canada (DFC), working on behalf of dairy producers, invest considerable sums of money in marketing activities for various dairy products. While previous studies (recently by Kaiser, Cranfield, and Doyon, 2006, 2007 and 2010) suggest that investment in generic fluid milk and cheese advertising and promotion does, indeed, generate a positive net return, sufficient time has lapsed to warrant a re-evaluation of these efforts. Moreover, the availability of a new source of data allows to a different type of modeling and the inclusion of more detailed household data.

This study estimates demand systems for Ontario and the Maritimes using data from A.C. Nielsen (i.e. Homescan) and data provided by DFC. It also estimates a demand systems for cheese in Canada (without Quebec) also using data from A.C. Nielsen (i.e. Homescan) and data provided by DFC. The Almost Ideal Demand System (AIDS), which allows estimated elasticities to vary over time, will be used in the econometric analysis. Based on these demand systems, simulation are used to undertake the calculation of return on investment.

Results for cheese

Results from the cheese demand system, indicate that consumption of cheese during the study period was most strongly affected by the price of cheese, followed by expenditure on protein sources, the price of meat, temporary price reduction (TPR), DFC investment in cheese promotion, DFC investment in nutrition communication, branded cheese advertising and lastly, DFC investment in generic cheese advertising. The own-price cheese demand elasticity is negative and significant, and indicates that the aggregate at home cheese demand is inelastic (but only just so). The cross-price elasticity of cheese demand with respect to meat is positive and significant, indicating cheese and meat are substitute goods, but that cheese demand is not too sensitive to changes in the price of meats. The elasticity of cheese demand with respect to protein expenditure is also positive and significant, but inelastic. The latter means that a one-percent increase in consumer expenditure on protein (in this case, expenditure on meat and cheese) leads to less than a one-percent increase in cheese demand.

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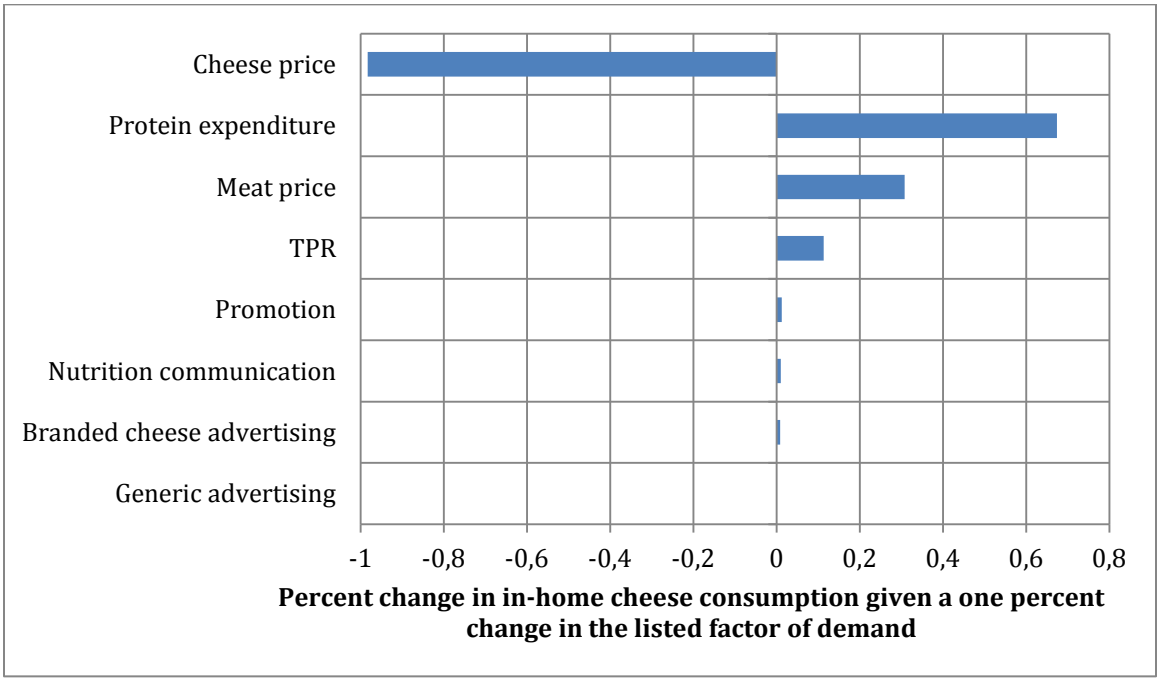
The elasticities of cheese demand with respect to generic advertising and promotion investment are both positive but not significant, while the elasticity with respect to nutrition communication is positive and significant. Amongst these DFC investment activities, cheese demand appears most responsive to promotion (Figure i), followed by nutrition communications and then generic advertising. The elasticity of cheese demands with respect to branded cheese advertising is positive (but not significant), indicating that increases in branded media investment increases demand for cheese. Lastly, the elasticity of cheese demand with respect to the share of the product category on Temporary Price Reduction (TPR) is positive and significant, and also large in comparison to the other marketing elasticities. This would suggest that cheese demand is quite responsive to price promotion compared to the generic advertising, promotion, nutrition communication and branded advertising effects.

Figure i: Plot of cheese demand elasticities



Additional analysis with a single equation model shed brighter light on the importance of household demographics with respect to cheese consumption. Two important points stand out. First, cheese consumption is higher in households with higher income. One interpretation of this effect is that economic downturns that lower household income, such as the 2008 recession, will lead to reduced cheese consumption. The second is that relative to households with no children, households with children between the ages of 13 and 17 had significantly higher cheese consumption during the study period, while households with children under 13 years of age consumed less cheese.

Simulations indicate that between 2007 and 2011, the demand for cheese has grown by 8%. However, in the absence of DFC's marketing activities, it is estimated that the demand would have grown by less than 1% over that same period.

This positive impact of DFC's marketing activities translates in an Average Producer Rate of Return (APROR) of 1.73 for all DFC's marketing activities for cheese in Canada (without Quebec) at the household level (Table i). In other words a dollar invested in marketing activities (the sum of advertising, promotion and nutrition communication) by DFC during the period 2007-2011 has generated $1.73 when looking at Canadian household consumption. Thus, farmers have made in average a net gain of $0.73 for every dollar invested in the cheese DFC promotion and nutrition package during that period. Since the APROR is useful in evaluating the overall effectiveness of advertising, it is of interest to also look at specific APROR for advertising, promotion and nutrition communication. Results indicate that in average, a dollar spent in advertising has generated a net loss of $0.99. During the 2007-2011 period, in average, advertising has not generated sufficient sales to cover its cost. At the opposite, a dollar spent in promotion or nutrition has generated a net gain of $1.89 and $4.11.

We now turn our attention to the Marginal Producer Rate of Return (MPROR). The MPROR indicates what the monetary return would be if spending in DFC's marketing activities was to be slightly increased (e.g. 1% per quarter). In economic optimization, in the absence of a budget constraint, one would invest until the marginal return is equal to one. Thus, a MPROR greater than one implies underinvestment (relative to an optimal) when looking at a specific marketing activity. On the other hand, and MPROR less than one implies overinvestment (relative to an optimal) for a specific marketing activity. MPROR helps to make optimal allocation level of marketing activities between dairy products and marketing vehicles. For cheese, the MPROR for DFC's marketing activities is 0.38 at the household consumption level. Since the MPROR is less than one, it appears that farmers would have gained by investing less in the marketing mix of DFC for cheese that was used for the 2007-2011 period. Looking at the specific MPROR at the household level, we found that too much is spent on advertising (0,01 < 1) and promotion (0.63 > 1). On the other hand, the level of spending on nutrition communication is adequate (coefficient near 1). If one was to keep the same level of spending, based on MPROR , marketing budget should be moved from advertising to nutrition communication and to a lesser extent to promotion.

Table i: Summary of APROR and MPROR for three marketing activities and their sum, for cheese in Canada (excluding Quebec), measured at the household level for the period 2007-2011

	APROR	MPROR
Total DFC marketing activities	1,73	0,38
Advertising	0,01	0,01
Promotion	2,89	0,63
Nutrition communication	5,11	1,10

It is very likely that DFC's marketing activities also impact consumption of cheese outside the home (restaurants, institutions, etc.). This spillover effect is estimated using the (documented) assumption that 20% of the difference between total cheese consumption and household consumption (roughly 1 kg per capita) can be attributed to DFC's marketing activities. The results are presented in Table ii.

Table ii: APROR and MPROR for three marketing activities and their sum, for cheese in Canada (excluding Quebec), measured at the household level with a spillover effect of 20% (1.02 kg), for the period 2007-2011

	APROR	MPROR
Total DFC marketing activities	1.98	0.45
Advertising	0.02	0.01
Promotion	3.41	0.74
Nutrition communication	5.82	1.29

Results at table i show that the spillover effect increases all the APROR and MPROR, but do not change our previous interpretations

Results for fluid milk in Ontario

Results from the Ontario beverage demand system indicate that in-home consumption of fluid milk in Ontario was most strongly affected by the price of milk, followed by expenditure on beverages, the price of dairy alternatives (e.g. soymilk, rice milk, water), the price of flavoured softdrinks, the price of juice, DFC investment in milk promotion activities, TPR, branded milk advertising, DFC investment in nutrition communication and lastly, DFC investment in generic milk advertising.

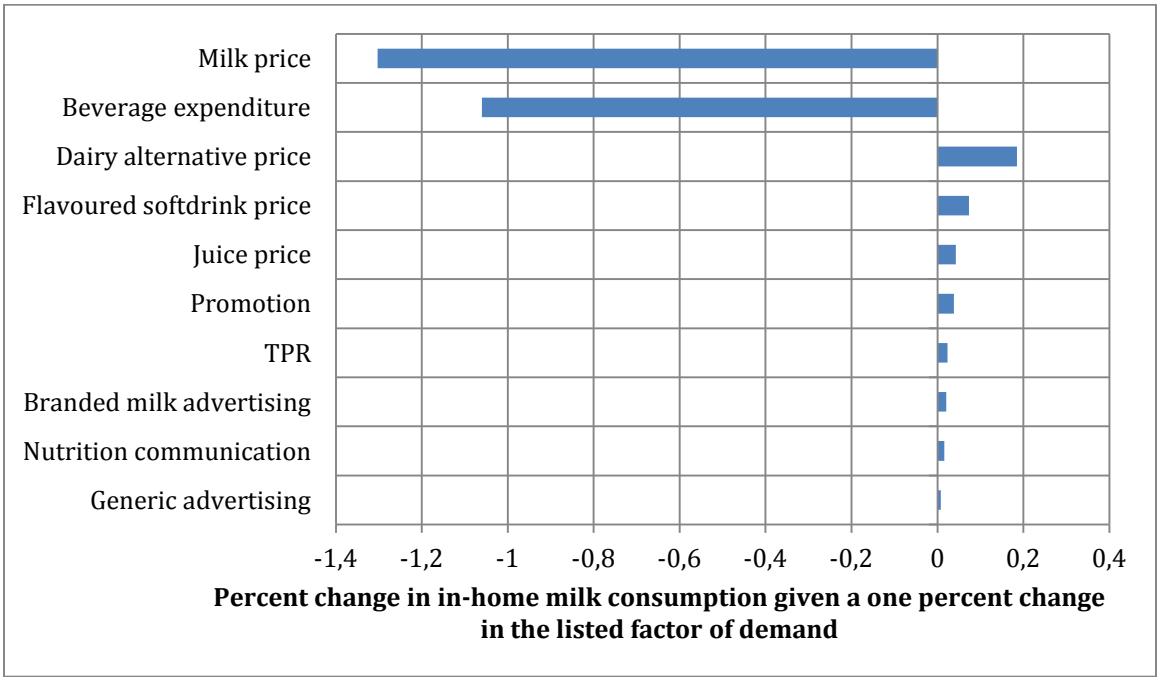
The own-price milk demand elasticity is negative and significant, and indicates milk demand in Ontario is elastic. The cross-price elasticities of milk demand with respect to the related beverages are all positive and significant, indicating these products are substitutes for milk in the eyes of Ontario households. The elasticity of milk demand with respect to beverage expenditure is significant but negative, thus indicating that as beverage expenditure grows demand for milk falls.

The elasticity of milk demand in Ontario with respect to generic advertising is positive, but not significant, while the elasticities with respect to promotion and nutrition communication are positive and significant. Amongst these DFC investment activities, milk demand in Ontario appears most responsive to promotion (Figure ii), followed by nutrition communication and then generic advertising. The elasticity of milk demand with respect to branded milk advertising is positive and significant; indicating that branded efforts can increase milk demand. Lastly, the elasticity of milk demand with respect to the product category TPR share is positive and but not significant.

Additional analysis using a single equation demand model for Ontario illustrated that a number of household demographics play an important role in shaping milk demand. Key amongst these are household income and the presence of children in the home. Households with income higher than

$85,000 had significantly higher milk consumption than households with income less than $40,000. Moreover, as households moved from the $85.000-$99,999 income bracket to having income of $100,000 or higher, this effect became more pronounced. Compared to households with no children, Ontario households with children under 13 years of age or between 13 and 17 years of age had significantly higher milk consumption. Moreover, the households with teens in them had higher milk consumption than households with only children under the age of 13.

Figure ii: Plot of fluid milk demand elasticities (Ontario)



Simulations issued from the econometric model indicate that between 2007 and 2011, the at home demand for fluid milk in Ontario has decreased by 3.2%. However, in the absence of DFC's marketing activities, it is estimated that the demand would have declined by 19% over that same period. Thus, DFC's marketing activities were instrumental in the maintaining of the market for fluid milk in Ontario.

This positive impact of DFC's marketing activities translates in an APROR of $4.51 for all DFC's marketing activities based on at home consumption of milk in Ontario (Table iii). In other words a dollar invested in marketing activities (the sum of advertising, promotion and nutrition communication) by DFC during the period 2007-2011 has generated in average a net gain of $3.51 for dairy farmers. When we disaggregate the marketing activities, simulations indicate that in average, a dollar spent in advertising has generated a net gain of $0.02, while promotion and nutrition communication have generated in average a net gain of $9.58 and $5.62, respectively during the same period.

Table iii: Summary of APROR and MPROR for three marketing activities and their sum, for fluid milk in Ontario, measured at the household level for the period 2007-2011

	APROR	MPROR
Total DFC marketing activities	4,51	0,93
Advertising	1,02	0,22
Promotion	10,58	2,29
Nutrition communication	6,62	1,36

According to the MPROR results, for fluid milk in Ontario, an extra dollar invested in marketing activities (the sum of advertising. promotion and nutrition) by DFC during the period 2007-2011 would have generated $0.93 at the Ontario household level . Thus, given that the ratio is near 1 and the expected error term associated with estimates, the level of investment seems appropriate. In other words, farmers would not have gain by investing more in the 2007-2011 marketing package of DFC for fluid milk in Ontario, but would have lost by investing less. However, better results could likely be achieved by reallocating the aggregate budget between marketing activities. For instance, based on the MPROR at the household level, too much is spent on advertising (MPROR 0.22 < 1) and not enough on nutrition communication and promotion (MPROR 2.29 and 1.36 > 1).

As for cheese, DFC's marketing activities also impact consumption of fluid milk outside the home (restaurants, institutions, etc.). A spillover effect is estimated using the (documented) assumption that 95% of the difference between fluid milk consumption and household consumption in Ontario (roughly 22 liter per capita) can be attributed to DFC's marketing activities.

Table iv:APROR and MPROR for three marketing activities and their sum, for fluid milk in Ontario, measured at the household level with a spillover effect of 95% (21.9 l) for the period 2007-2011

	APROR	MPROR
Total DFC marketing activities	6.19	1.27
Advertising	1.39	0.30
Promotion	14.50	3.14
Nutrition communication	9.07	1.86

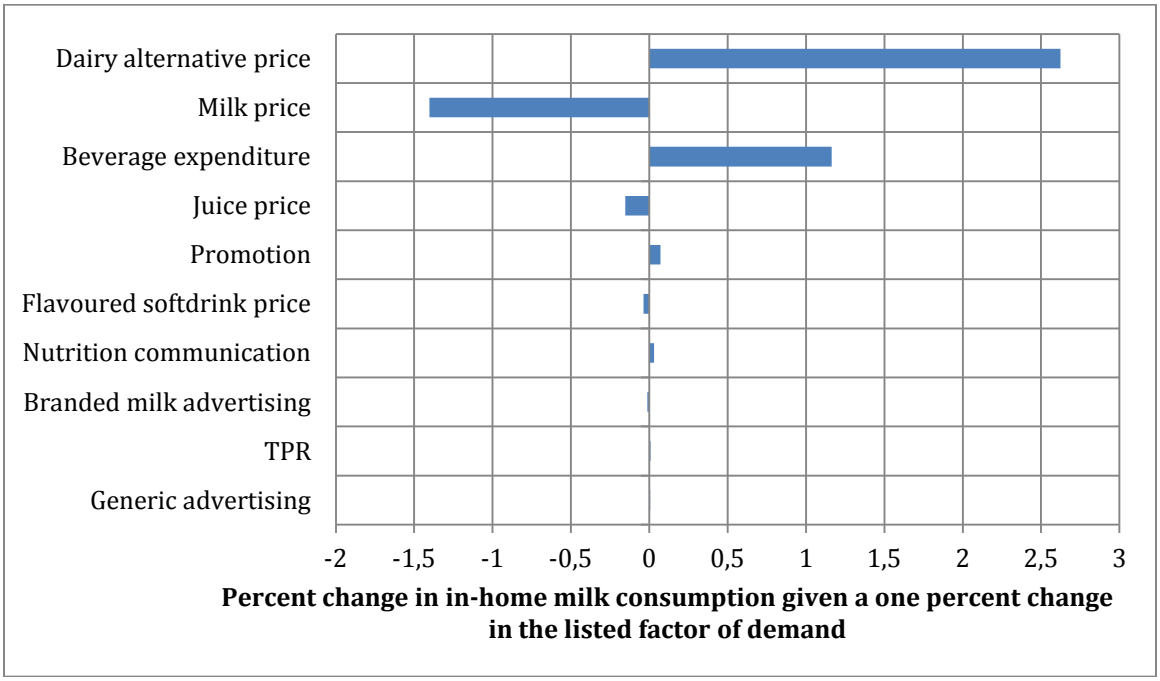
Results at table iv show that the spillover effect increases all the APROR and MPROR. It confirms that the aggregate level of spending is adequate for fluid milk in Ontario, and that it would even be beneficial to increase it at the margin. Otherwise, the inclusion of the spillover effect does not change our previous interpretations.

Results for fluid milk in the Maritimes

Results from the Maritime beverage demand system indicate that in-home consumption of fluid milk in the Maritimes was most strongly affected by the price of dairy alternatives, followed by the price of milk, expenditure on beverages, the price of juice, DFC investment in milk promotion activities, the price

of flavoured softdrinks, DFC investment in nutrition communication, branded milk advertising, TPR and lastly DFC investment in generic milk advertising (Figure iii).

Figure iii: Plot of fluid milk demand elasticities (Maritimes)



The own-price milk demand elasticity is negative and significant, and indicates milk demand is elastic. The cross-price elasticities of milk demand with respect to the price of related beverages are all significant but have differing signs. The cross-price elasticity with respect to dairy alternatives is positive and elastic, indicating milk and dairy alternatives are substitutes in Maritime households and that demand for milk in the Maritimes is very sensitive to the price of dairy alternatives. The cross-price elasticity of demand for flavoured soft drinks and juices are negative, indicating that the demand for these goods is behaving similarly to a complement good to milk. The elasticity of milk demand with respect to beverage expenditure is positive and significant, indicating that as household expenditure on beverages increases, so too does demand for milk, but at a quicker rate.

The elasticity of milk demand with respect to generic advertising is positive, but not significant, while the elasticities with respect to promotion and nutrition communication are positive and significant. Amongst these DFC investment activities, milk demand in the Maritimes is most responsive to promotion, followed by nutrition communication and then generic advertising. The elasticity of milk demand with respect to branded milk advertising is negative but not significant. Lastly, the elasticity of milk demand with respect to TPR is positive but not significant.

As with the cheese and Ontario milk analysis, additional analysis using a single equation demand model for the Martimes illustrated that a number of household demographics play an important role in shaping milk demand. Household income and presence of children in the home figure largely into this. In

particular, compared to households with income under $40,000, Maritime households in higher income categories had higher milk consumption. Moreover, relative to households with no children, households with children under 13 years of age consumed significant less milk, while households with children between the ages of 13 and 17 had significantly higher milk consumption during the study period.

Similarly to fluid milk in Ontario, simulations indicate that between 2007 and 2011, the at home demand for fluid milk in the Maritimes has decreased by 5%. However, in the absence of DFC's marketing activities, it is estimated that the demand would have declined by 29% over that same period. Thus, DFC's marketing activities played a major role in the maintaining of the market for fluid milk in the Maritimes.

This positive impact of DFC's marketing activities translates in an APROR of $7.15 for all DFC's marketing activities based on at home consumption of milk in the Maritimes. In other words a dollar invested in marketing activities (the sum of advertising, promotion and nutrition communication) by DFC during the period 2007-2011 has generated in average a net gain of $6.15 for dairy farmers. When we disaggregate the marketing activities, simulations indicate that in average, a dollar spent in advertising has generated a net loss of $0.30, while promotion and nutrition communication have generated in average a net gain of $17.11 and $10.44, respectively during the same period.

According to the MPROR results, for fluid milk in the Maritimes, an extra dollar invested in marketing activities (the sum of advertising. promotion and nutrition communication) by DFC during the period 2007-2011 would have generated $1.55 when looking at household consumption (Table v). Thus, the level of investment should be increased at the margin. In other words, farmers would have gained by investing more in the 2007-2011 marketing package of DFC for fluid milk in the Maritimes. More specifically, greater gain would have resulted from less spending in advertising (MPROR 0.15 < 1) and greater spending in promotion and nutrition, since their MPROR are 3.91 and 2.49 respectively (greater than 1).

Table v: Summary of APROR and MPROR for three marketing activities and their sum, for fluid milk in the Maritimes, measured at the household level for the period 2007-2011

	APROR	MPROR
Total DFC marketing activities	7,15	1,55
Advertising	0,70	0,15
Promotion	18,11	3,91
Nutrition communication	11,44	2,49

As for cheese and fluid milk in Ontario, the impact has been measured only at the household level. To take into account the fact that DFC's marketing activities also impact consumption of fluid milk in the Maritimes outside the home (restaurants. institutions. etc.). This spillover effect is estimated using the (documented) assumption that 95% of the difference between fluid milk consumption and household

consumption in the Maritimes (roughly 22 liter per capita) can be attributed to DFC's marketing activities.

Table vi: APROR and MPROR for three marketing activities and their sum, for fluid milk in the Maritimes, measured at the household level with a spillover effect of 95% (22.3 l) for the period 2007-2011

	APROR	MPROR
Total DFC marketing activities	9.94	2.15
Advertising	0.97	0.21
Promotion	25.17	5.44
Nutrition communication	15.91	3.46

Results at Table vi show that the spillover effect increases all the APROR and MPROR. It confirms that the aggregate level of spending for fluid milk in the Maritimes should be increased at the margin, and a reallocation of budget from advertising to promotion and nutrition communication should be made. The inclusion of the spillover effect does not change our previous interpretations.

Allocation issues

The marginal analysis can be used to look more closely at the allocation level of DFC's dollars in marketing activities between products (cheese in Canada without Quebec, fluid milk in Ontario and the Maritimes) and marketing tools (advertising, promotion and nutrition communication). It appears that the global level of spending is too high for cheese, almost sufficient for fluid milk in Ontario and should be increased for fluid milk in the Maritimes. Thus, based on simulation results, moving marketing activities budget from cheese to fluid milk in the Maritimes would result in more dollars for dairy farmers at no supplemental costs. Moreover, gain can also be made for each product by reallocating budget amongst marketing activities. For instance, for the three products, the MPROR level of spending indicates benefits in reducing the level of spending on advertising. More specifically, for cheese, the level of advertising should be reduced and to a lesser extent the level of promotion. The level of spending on nutrition communication for cheese seems appropriate. For fluid milk in Ontario, when taking into account the spillover effect, the global level of marketing activities should be increased. However, less money should be spent on advertising while the promotion budget should be increased, and to a lesser extent the nutrition communication budget. Fluid milk in the Maritimes would benefit the most from a marginal increase in marketing activities. As in Ontario, the advertising budget should be reduced, while significant gain would be generated by an increase in promotion budget, and to a lesser extent in nutrition.

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ECONOMIC EVALUATION MODELS OF GENERIC FLUID MILK AND CHEESE MARKETING INVESTMENT IN CANADA FOR THE 2007-2011 PERIOD

1. INTRODUCTION

The Dairy Farmers of Canada (DFC), working on behalf of dairy producers, invest considerable sums of money in generic advertising and promotion of various dairy products. Given that a large portion of this investment is devoted to fluid milk and cheese, it is important for dairy farmers to evaluate the impact of generic advertising and promotion on sales of these products, and, more importantly, the return on their investment. This is especially true given these activities are financed by check-off revenues levied at the farm level. While previous studies (recently by Kaiser, Cranfield, and Doyon, 2006, 2007 and 2010) suggest that investment in generic fluid milk and cheese advertising and promotion does, indeed, generate a positive net return, sufficient time has lapsed to warrant a re-evaluation of these efforts. Moreover, the availability of a new source of data allows to a different type of modeling and the inclusion of more detailed household data.

Accordingly, the objective of this study is to assess producers' return on fluid milk and cheese advertising and promotion activities using econometric models of fluid milk and cheese demand in Canada. More specifically, the objectives are:

1. To estimate beverage demand systems for Ontario and the Maritimes that can be used to assess the impact of marketing investment (including investment in nutrition communication, general product communications and promotion) on demand for fluid milk in these regions;
2. To estimate a cheese demand model (i.e. a demand system) for Canada that can be used to assess the impact of marketing investment (including investment in nutrition communication, , general product communications and promotion) on demand for cheese in Canada;
3. To use simulations from the estimated models to calculate a return on investment in marketing and nutrition communication activities for fluid milk in Ontario and the Maritimes and cheese in Canada.

2. METHODS AND DATA

There are three components of this project. The first estimates beverage demand systems for Ontario and the Maritimes using data from A.C. Nielsen (i.e. Homescan) and data provided by DFC. These models (one for Ontario and one for the Maritimes) include fluid milk as one of the

beverages. The second component develops a model for cheese demand in the provinces of Canada in which DFC undertakes cheese market activities (for simplicity, called Canada in this report) using AC Nielsen Homescan data. This model includes cheese as well as another protein sources as the relevant products. Both milk models, as well as the cheese model, will include relevant economic variables, as well as DFC's investment in marketing activities (generic advertising and promotion) and nutrition communication activities in the respective region. Given these models are estimated with Homescan data, the included variables capture the composition of the household (e.g. household size, age composition of the home, presence of children in the target market age range, etc.). Potential seasonality, as well as potential effect of cross-border shopping effects (measured using a count of the daily trips to the US from the respective region) and impact of price promotion on demand for milk and cheese are taken into account. The models also account for branded investment in marketing activities. All models are estimated using quarterly data.

The Almost Ideal Demand System (AIDS) is used in the econometric analysis. Use of the AIDS model has the advantage to allow the estimated elasticities to vary overtime, thus informing DFC regarding potential changes in the relationship between fluid milk demand and related prices, expenditure/income and marketing and nutrition communication investment. It is important to point out that since consumption is observed at the household level, but investment is observed at the regional level (i.e. Ontario or the Maritimes for milk, Canada for cheese), that it is assumed that each household in the respective region is exposed to the same level of marketing and nutrition communication activity by DFC.

The third component undertakes calculation of return on investment. In particular, estimates from models are used to undertake counter-factual simulations that enables prediction of demand for milk or cheese, respectively, in the absence of DFC investment. Results are also used to calculate the return on investment associated with advertising, promotion and nutrition communication activities.

2.1. Econometric specification

As mentioned, the econometric analysis uses an Almost Ideal Demand System model (or AIDS model, see Deaton and Muellbauer 1980). This model has been used extensively in modelling consumer demand for food and agricultural products for over thirty years. In this system, one does not estimate a single equation for the product of interest, but a set of equations that includes the food product of interest and related goods.

The AIDS model is written as:

$$w_{it} = \alpha_i + \sum_{l=1}^{n} \zeta_{il} \ln\left(p_{lt}\right) + \beta_i \ln\left(\frac{y_t}{P_t^*}\right) \qquad (1)$$

where w_{it} is the ith good's share of expenditure in time period t, p_{it} is the ith good's price in time period t, y_t is consumer expenditure (or income), P_t^* is a price index of the goods in the consumer's bundle, and α_i, ζ_{il}, and β_i are unknown parameters to be estimated. It is important to note that while terms are included in natural logarithms, this does not mean the elasticities are constant. In fact, with the AIDS model the elasticities vary with the parameters of the model and the underlying data. To be consistent with economic theory, adding-up, homogeneity and symmetry restrictions are imposed during estimation. The price index used in the last term of (1) varies with model to be estimated. In the case of the cheese model and the milk model for the Maritimes, the Translog price index is used, while Stone's price index is used for the Ontario milk model (this issue will be discussed in the results section).

In principle all goods in the consumer basket could be included in the milk models, as well as the cheese model. However, to simplify estimation, and to reflect data limitations, weak separability is assumed. In the milk models we assume non-alcoholic beverages are weakly separable from all other goods, while in the cheese model we assume food products that offer a significant source of protein are weakly separable from all other goods. The consequence of this assumption is that in the beverage models, demand for each beverage that will be included will depend on the prices of those beverages and expenditure on those beverages. In the cheese model, demand for the goods in that model will depend on the price of those goods and expenditure on those sources of protein.

To reflect the role of forces other than prices and expenditure in shaping demand, the intercept in each equation (i.e. α_i) is replaced with a function that is linear in the parameters and includes a time trend, quarterly dummy variables, demographic variables and variables related to DFC activities and other factors which might influence demand. The demographic variables include a dummy variable indicating whether the household speaks a language other than English, a dummy variable indicating whether the household includes a married couple, household size, a set of dummy variables indicating the age of the household head, a dummy variable indicating whether children under 18 years of age are present in the home, and dummy variables for the province in which the household resides.

The function that replaces α_i also includes deflated, per-capita investment by DFC in generic advertising, promotion and nutrition communication, as well as a variable measuring deflated, per-capita branded media activity related to the respective good (i.e. either milk or cheese). To impose diminishing marginal returns to investment activity (a standard practice in this type of analysis), the DFC investment variables, and brand advertising variable, are included in their logs. It is important to note that even those advertising, promotion and nutrition communication are included in their logs, the elasticities for these variables will not be constant, but will depend on the estimated parameters and underlying data.

Variables capturing the percent of the product sold under price promotion (TPR) and count of the number of cars crossing into the US from the respective Canadian region (for a single day visit) are also included. Given that the Translog price index in (1) includes the α_i terms, the translation of α_i to reflect these demographic and other forces means that the Translog price index in the Maritime milk and cheese models incorporates these variables. Consequently, the effect of these demographic, marketing and other variables on demand will be non-linear in nature and one cannot use the coefficient estimates to *directly* infer their impact on demand.

2.2. Data

This section provides a summary of the relevant Homescan data (in particular budget shares, prices and expenditure), as well as examines differences in key characteristics of households who purchase and do not purchase milk or cheese. The other variables included in the model are also discussed and summarized. Unless otherwise stated, all data are from the Homescan database provided by DFC to the researchers.

The Homescan data offers a unique snapshot of the food purchased for in-home consumption. Unlike CDIC or Statistics Canada data, which is captured through plant surveys or supply-disposition tables and hence captures the total market (consumption in the in-home and food service channels), Homescan data is collected through a panel of household survey and captures in-home consumption only. Each household, which can be in the panel for a number of years, records the purchase of foods for in-home consumption by either scanning the product's UPC code or recording the quantity and amount spent on the food product if the item has no UPC code. In addition to gathering information about what is bought and how much is spent, the data collects demographic socio-economic information for the household. What is important to recognize is that unlike data from Statistics Canada or other reporting bodies, the Homescan data shows what was actually purchased (whereas national account data shows, for instance, disappearance of the food product of interest).

The data are captured at a household level and reported to us on a quarterly basis between 2007 and 2011. In the cheese data there are approximately 7,500 households in each quarter, with a total 153,120 observations. The fluid milk data for Ontario has about 3,200 households per quarter, with a total of 65,114 observations, while that for the Maritimes has about 1,200 households per quarter and a total of 24,502 observations. Recognize that not all households appear in each quarter, and that some households joined or left the panel during the study period.

2.2.1. Cheese Data

Based on early discussion with representatives of DFC, the cheese model includes two goods: cheese and meat. Cheese included both pre-packaged and deli cheeses, while meat included

muscle-cuts and ground products, but not further processed meat products (e.g. prepared meals include a meat product).[3] Figure 1 shows the average share of total protein expenditure allocated to meat and cheese in each year (note that we observe this share for each household, in each quarter and each year, but report an average across years as a convenient summary). What is evident is that for both cheese and meat, the share of protein expenditure allocated to each good appeared relatively constant up to 2009, with meat's share falling in 2010, but cheese's share rising in 2010.

Figure 1: Average budget shares for meat and cheese, Canada 2007-2011

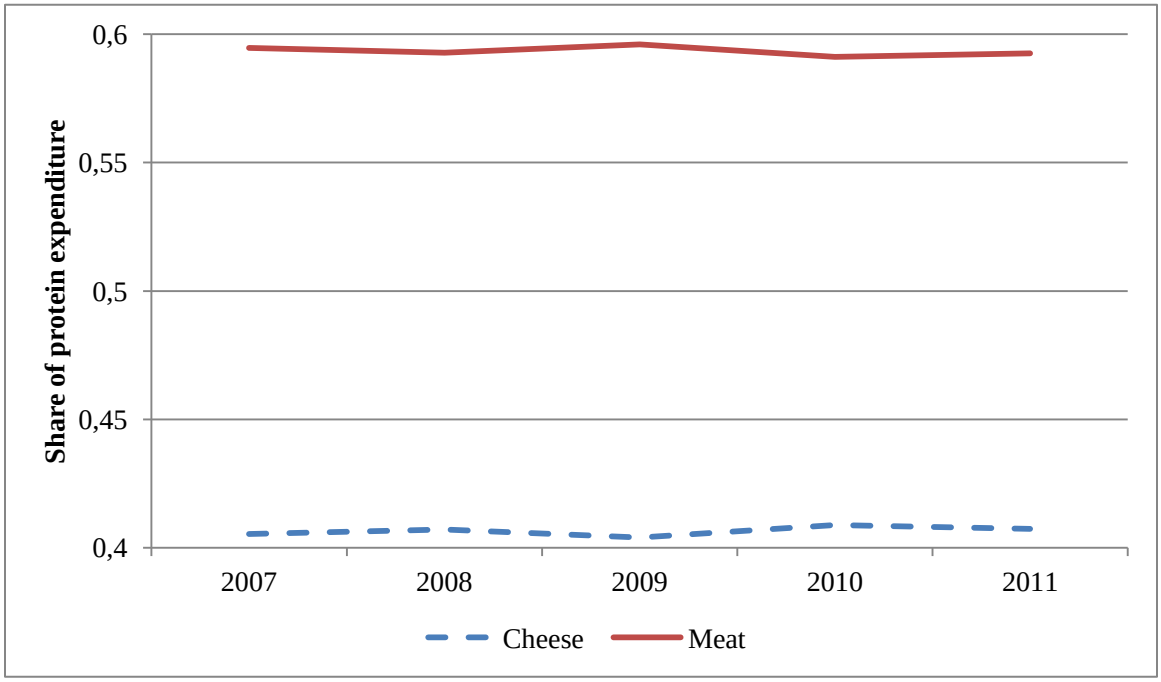


Figure 2 plots average per capita cheese demand for 2007-2011 based on data available through the CDIC and the Homescan data. Two points standout. First, per capita cheese consumption in the Homescan data is lower than that report by the CDIC. This difference is expected, as the Homescan data only capture purchase of packaged or deli cheese for consumption in the home. Homescan does not capture out-of-home cheese consumption, or consumption of food products that might contain cheese products; the CDIC data will capture in-home as well as out-of-home cheese consumption, as well as consumption of food products containing cheese. The second point is that per capita cheese purchases in the Homescan data shows a slight upwards trend between 2007 and 2011.

[3] Note that the data were provided to us at a highly aggregated level, making it impossible to know the precise detail of every single product (i.e. products based on an SKU or UPC) in the Homescan data.

Figure 2: Annual per capita cheese consumption, Canada without Quebec, 2007-2011.

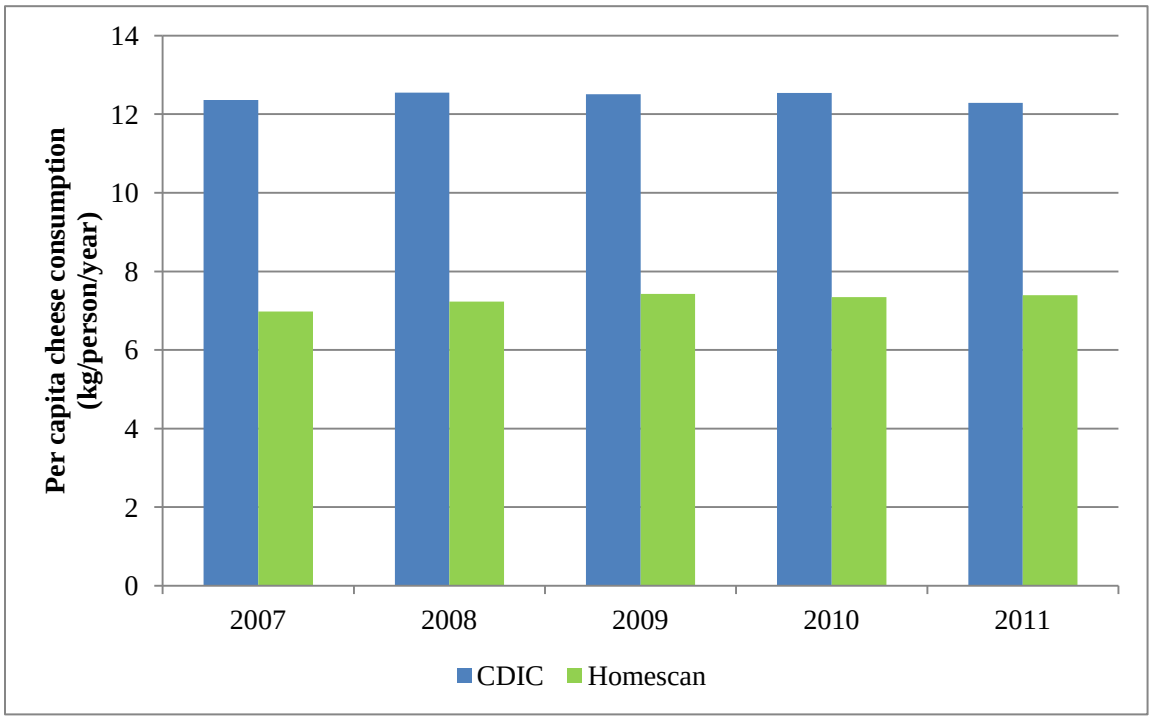
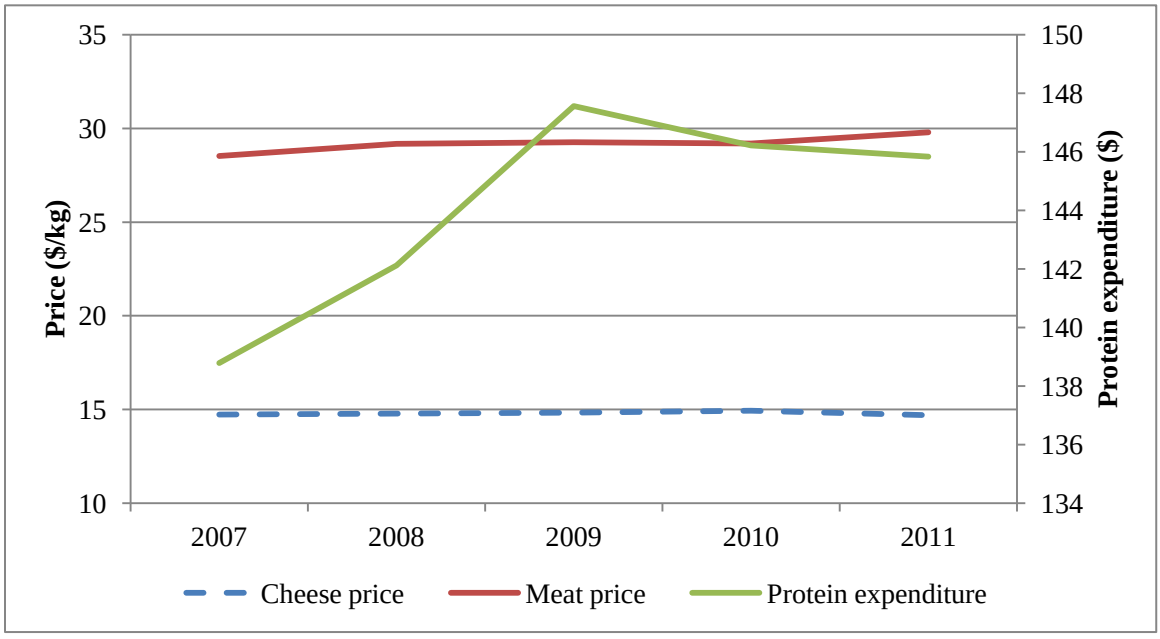


Figure 3 shows the average of the unit price for cheese and meat, and total protein expenditure, in each year of the study period. Note that all prices and dollar values, unless otherwise stated, are shown in nominal terms, but that the econometric analysis accounts for relative prices (i.e. inflation). On average, the unit price for cheese was relatively constant, while that for meat rose slightly. Protein expenditure increased initially, but decline after 2009.

Figure 3: Average prices for meat and cheese and total protein expenditure, Canada 2007-2011



To understand differences in the characteristics of households and possible impacts in consumption across household, we look at income, the presence of children of varying ages in the home and the life-stage variable (for further household characteristics related to consumption see the Appendix). Figure 4 shows a positive relationship between household income and quantity of household cheese purchased. But also notice that after $85,000 in household income, average quantity purchased does not vary substantially.

Figure 5 shows that households with children under the age of 18 purchase more cheese per quarter than households with no children under the age of 18. Moreover, regardless of whether there is one child under 18 in the home, or more than one under 18 years, the average household purchase of cheese increases with the age of the oldest child. For instance, a household with a child between the ages of 13 and 17 will purchase more cheese than a household with children under 13 years of age.

Figure 4: Average (2007-2011) household cheese purchases, by household income

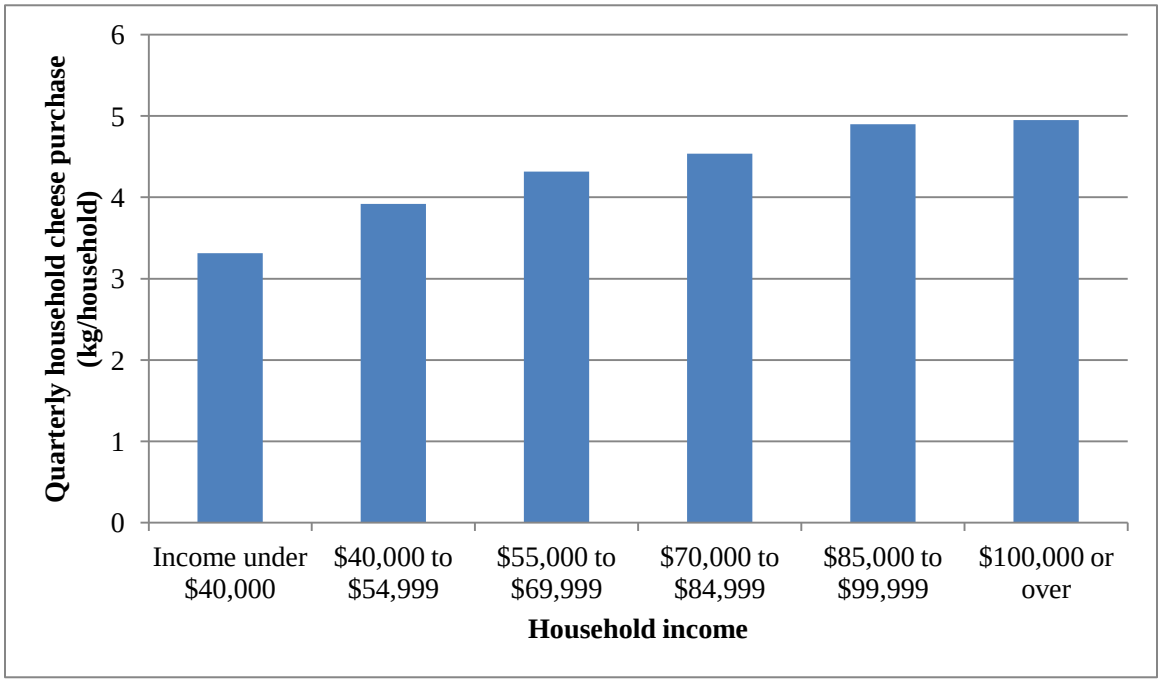


Figure 5: Average (2007-2011) household cheese purchases, by presence of children in the home

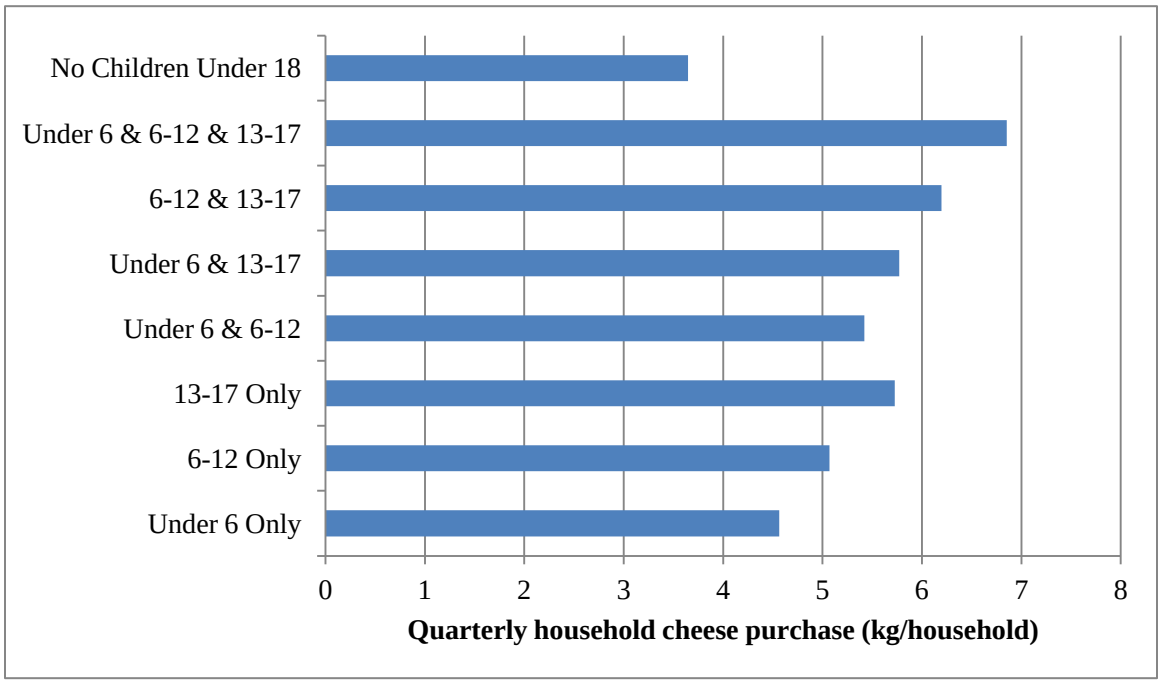
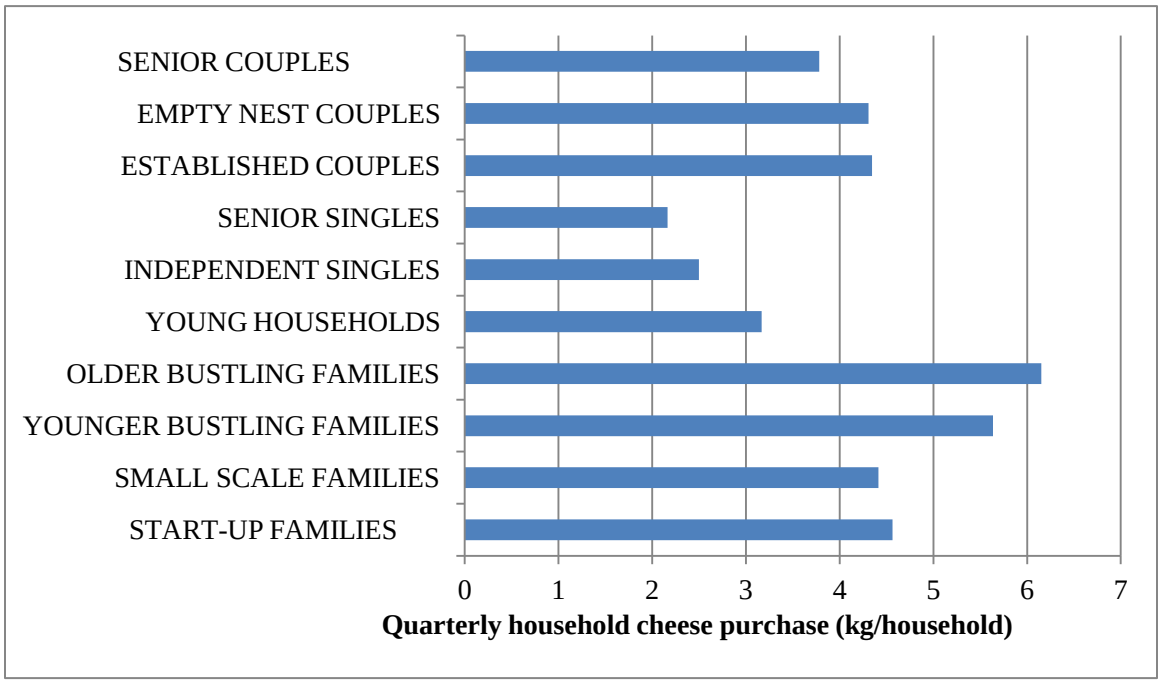


Figure 6 shows that households with single individuals or younger households purchased the least amount of cheese, while bustling households purchased the greatest amount of cheese, and households with just a couple or small scale and start-up families were in between these two groups in terms of cheese purchase.

Figure 6: Average (2007-2011) household cheese purchases, by life-stage



DFC investment in cheese marketing and nutrition communication was captured using three variables: generic advertising, promotion and nutrition communication. For all three of these variables, relevant production and media costs were included, while fixed costs, such as agency costs or fixed website costs were excluded from the econometric analysis, but included in the ROI calculations.

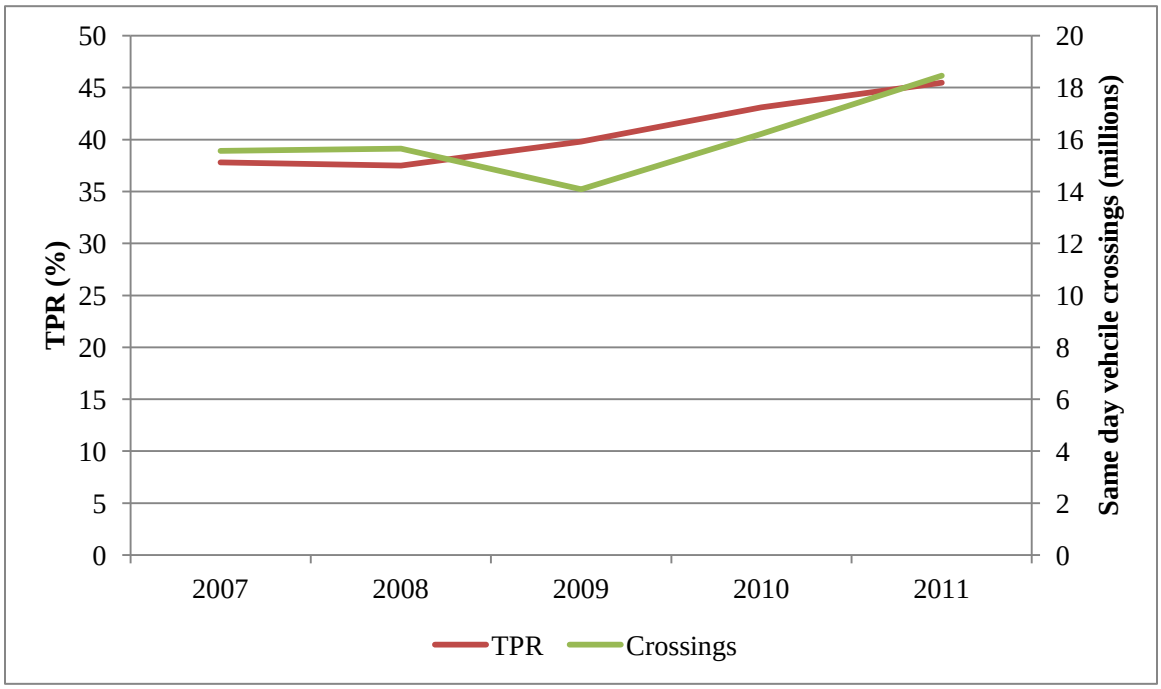
The production and media cost categories were developed in consultation with DFC and reflected our earlier evaluation efforts. These data were provided to us by DFC. The generic advertising category included media and production spend on: outdoor, theatre, print, television, radio, and internet. For promotion, the production and media costs included spend on: fairs and exhibitions, sponsorships; in-store promotions; AYNIC magazine; the Canadian cheese Grand Prix; cheese rolling; brand-book; and a miscellaneous category.

For the cheese model, nutrition communication included one-third of DFC production and media costs related to nutrition communication activities, under the following areas: outdoor, theatre, print, television, radio, internet, and other. The one-third allocation of overall nutrition communication spend was agreed upon with DFC early in the research process. In cases where DFC investment in an activity was lumpy, such as with the Grand Prix, the investment was smoothed over one year.

From an econometric point of view, it is important to account for the potential impact of branded cheese advertising. Omitting branded advertising from the analysis could lead to a biased estimate of generic advertising's effect on milk demand. To this end, branded cheese media costs were provided by DFC for inclusion in the analysis. Data indicate a significant reduction in 2009, but an overall upward trend between 2007 and 2011.

The percent of the product sold under price promotion (TPR) and count of the number of cars crossing from Canada to the US (for a single day trip) were also included to capture the impact of price promotion and to control for potential cross-border shopping effects. Note that in the cheese model, the counts for the number of single day trips were region specific (i.e. the count of single day crossings was not a national figure); for example households in Alberta were assigned the counts of the single day trips through ports in Alberta. Figure 7 shows the quarterly average TPR and count of vehicle border crossings for the period 2007-2011. Clearly, the percent of cheese sold on price promotion rose during the study period. As well, there was a decrease and then increase the number of same day vehicle traffic over the Canada-US border over this period.

Figure 7: Quarterly average TPR and vehicle border crossings from Canada to the US, by year



2.2.2. Ontario Milk Data

The Ontario milk model included four goods: fluid milk, dairy alternatives (e.g. soymilk, rice milk, flat water, and carbonated water), flavoured soft drinks (i.e. carbonated soft drinks), and juices (fresh and frozen). Figure 8 shows the quarterly average share of total beverage expenditure for these four beverages across 2007-2011. Fluid milk held the large share of beverage expenditure, followed by juices, flavoured soft drinks and dairy alternatives.

Figure 8: Average budget shares for beverages, Ontario 2007-2011

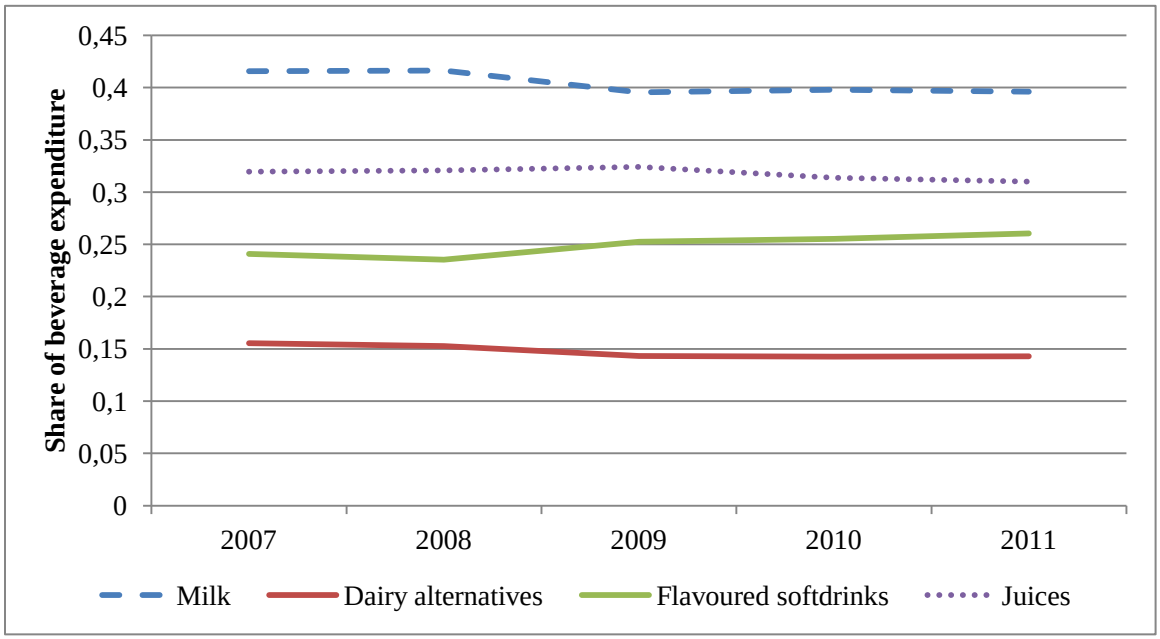


Figure 9 plots average per capita milk demand for Ontario (2007-2011) based on data available through the CDIC and the Homescan data. Two points standout. First, per capita milk consumption in the Homescan data is lower than that report by the CDIC. As with cheese, the difference is expected, as the Homescan data only capture purchase of milk for consumption in the home (i.e. it does not include consumption in the out-of-home channels), whereas the CDIC data will in and out-of-home milk consumption. The second point is that per capita milk purchases in the Homescan data shows a slight downwards trend between 2007 and 2011.

Figure 9: Average annual per capita milk consumption, Ontario 2007-2011.

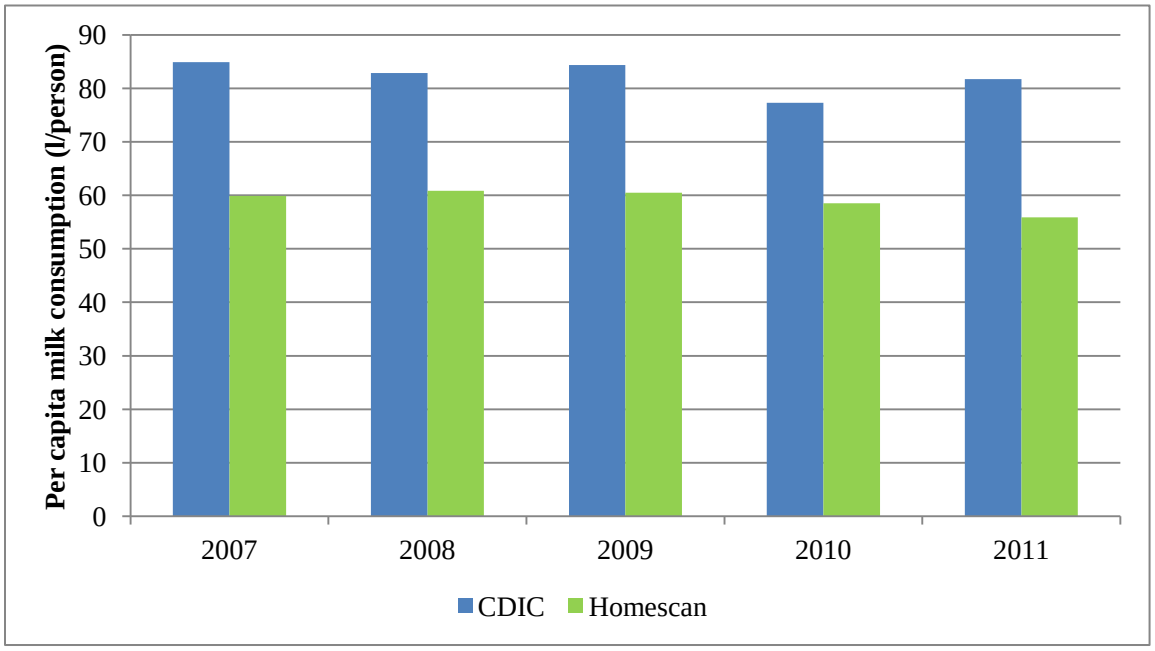
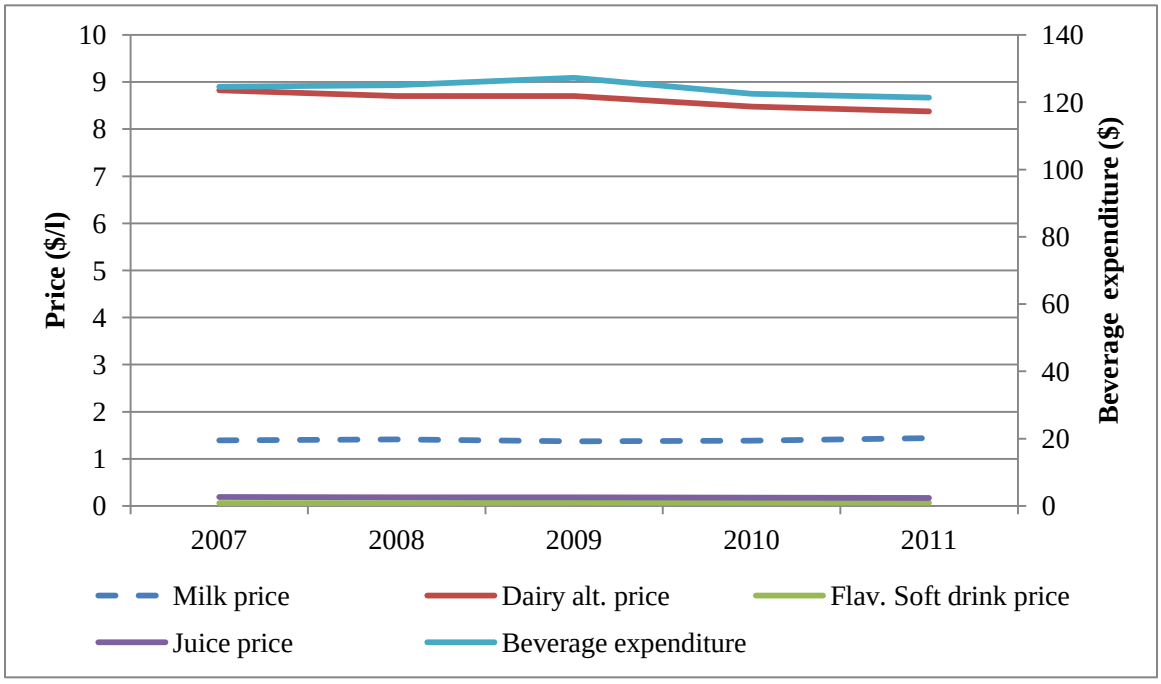


Figure 10 shows averages of the unit price for the four beverages, and total beverage expenditure across years in the study period. On average, the unit price for dairy alternatives was very high over the study period, followed by the price of fluid milk, juices and flavoured soft drinks. While total expenditure on beverages was relatively constant up to 2009, it declined thereafter.

Figure 10: Average prices for milk, dairy alternatives, flavoured soft drinks and juices, and total beverage expenditure, Ontario 2007-2011



As with cheese, it is important to understand differences in household characteristics across households (for further household characteristics related to consumption see the Appendix).

Figure 11, 12 and 13 show household milk consumption across household income, the presence of children of varying ages in the home and the life-stage variable, respectively. Figure 11 shows a positive relationship between household income and quantity of household milk purchases. Figure 12 shows that households with children under the age of 18 purchase more milk per quarter than households with no children under the age of 18 (on average). Regardless of whether there one or more children under 18 years of age in the home, average household purchase of milk increases with the presence of children of progressively higher ages. For instance, a household with a child between the ages of 13 and 17 will purchase more milk than a household with children under 13 years of age.

Figure 11: Average (2007-2011) Ontario household milk purchases, by household income

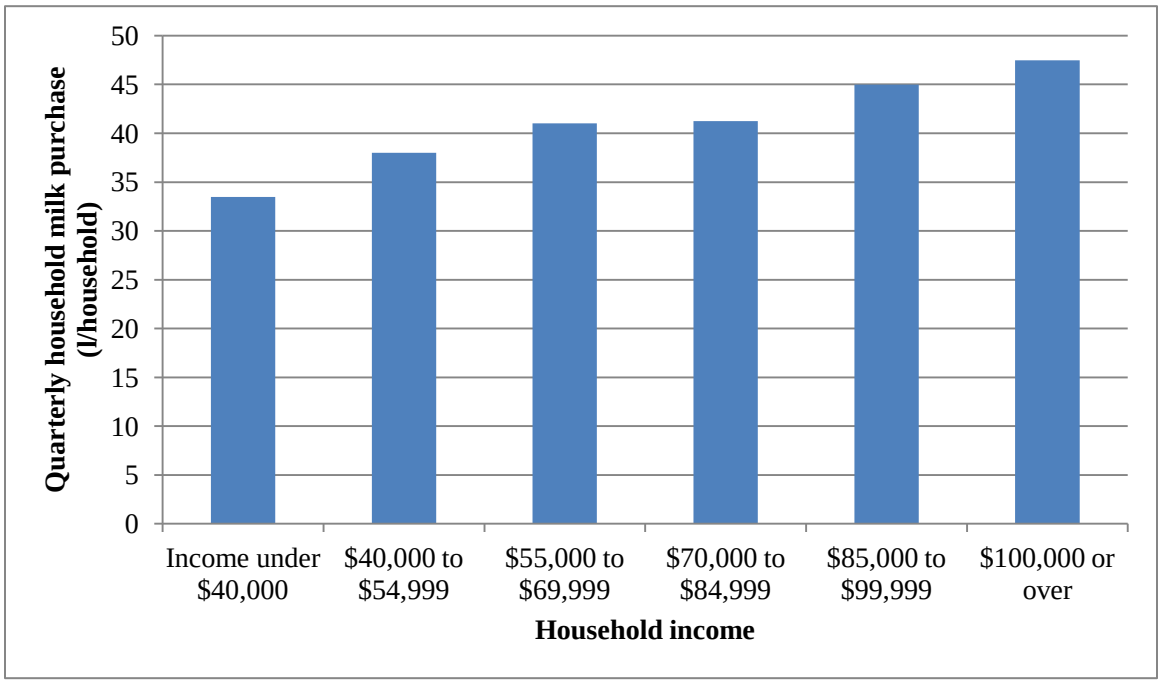


Figure 12: Average (2007-2011) Ontario household milk purchases, by presence of children in the home

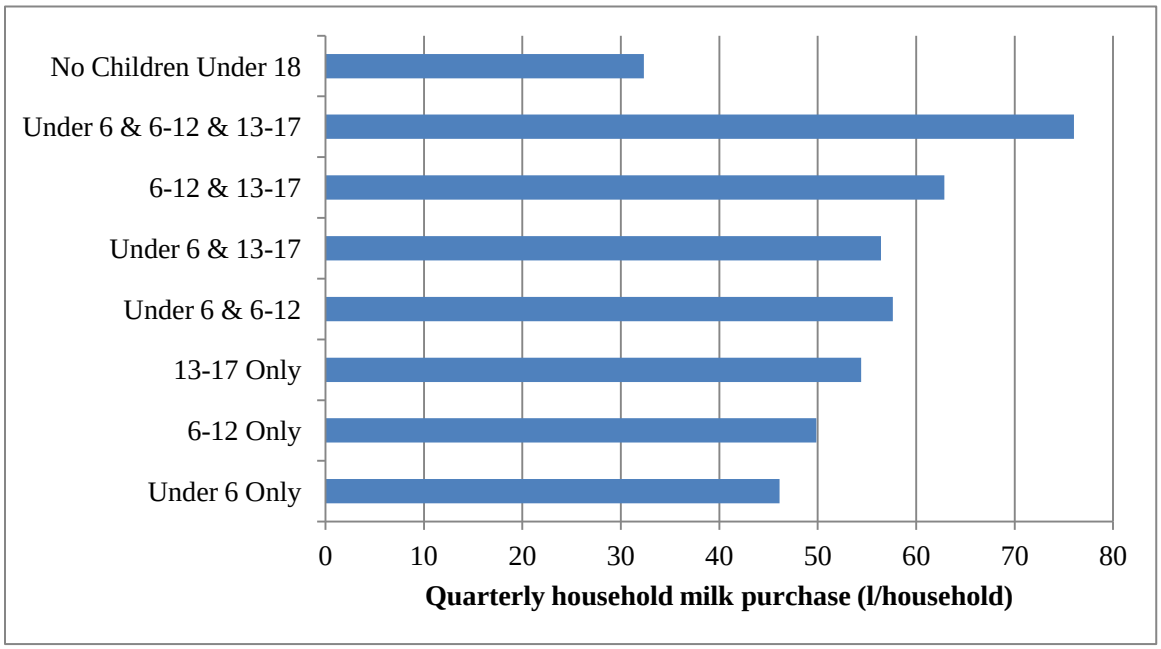
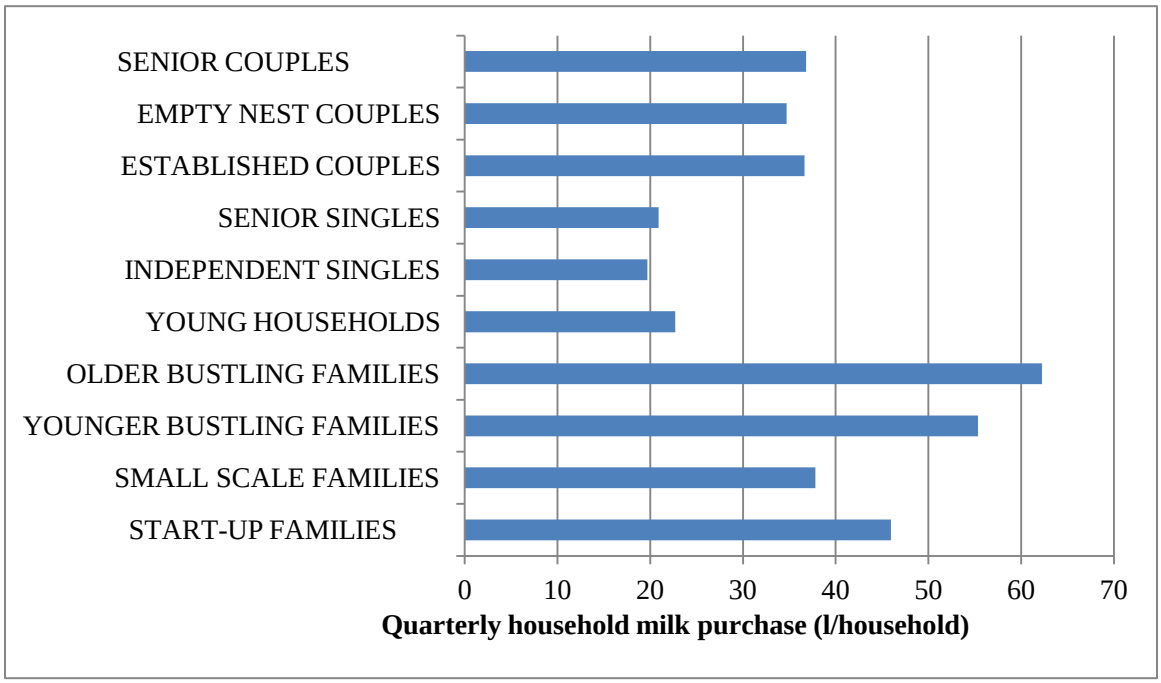


Figure 13 shows that households with single individuals or younger households purchased the least amount of milk, while bustling households purchased the greatest amount of milk, and households with couples or small scale and start-up families were in between these two groups in terms of quantity of milk purchased.

Figure 13: Average (2007-2011) Ontario household milk purchases, by life-stage



As with cheese, DFC investment in milk marketing and nutrition communication was captured using generic advertising, promotion and nutrition communication. For all three of these variables, relevant production and media costs were included, while fixed costs, such as agency costs or fixed website costs were excluded from the econometric analysis, but included in the ROI calculations.

The production and media cost categories were developed in consultation with DFC and reflected our earlier evaluation efforts. These data were provided to us by DFC. The generic advertising category included media and production spend on: outdoor, theatre, print, television, radio, and internet. For promotion, the production and media costs included spend on: teen oriented strategies; Recharge with Milk; the Milk Calendar; ESMP; business development/PR and a miscellaneous category.

For the cheese model, nutrition communication included one-third of DFC production and media costs related to nutrition, under the following areas: outdoor, theatre, print, television, radio, internet, and other, as well as the milk specific investment in nutrition communication. As with cheese, in cases where spend was lumpy, such as with the milk calendar, the investment was smoothed over a year.

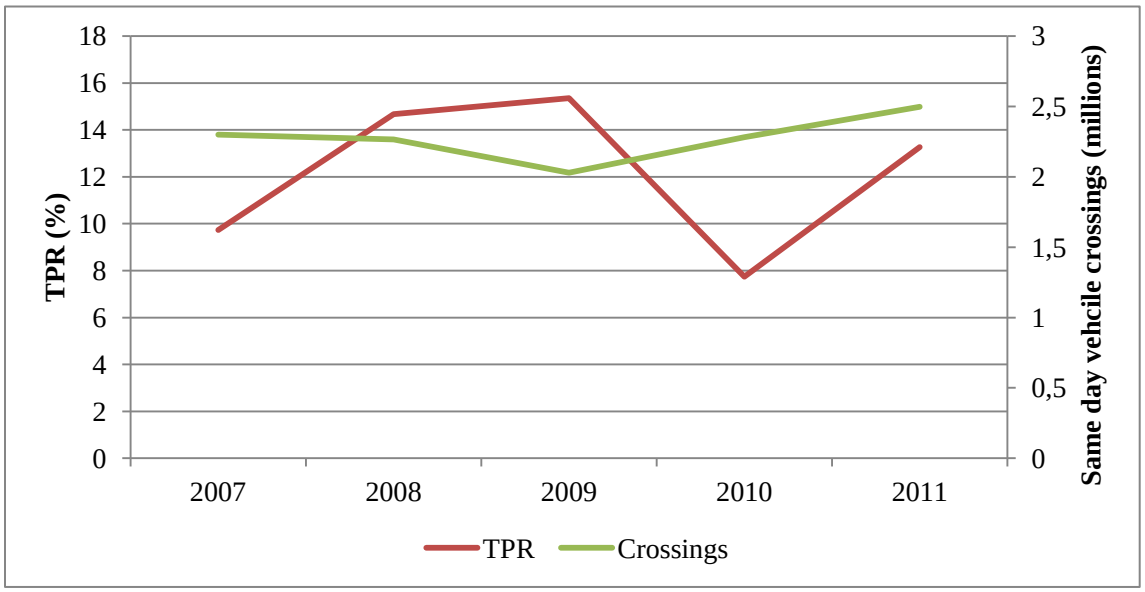
Since the DFC milk investment data for each of generic advertising, promotion and nutrition communication was provided for Ontario and the Maritimes together, it was not possible to separate these data into region specific investments. As such, for each category the same per-capita, deflated (based on the population in Ontario and the Maritimes, and Consumer Price Index in these two regions) investment was used in both the Ontario and Maritime models. This

approach assumes that residents in Ontario and the Maritimes are exposed to the same level of per-capita, deflated investment in: 1) generic advertising, 2) promotion, and 3) nutrition communication, an approach which aligns with DFC allocations.

The impact of branded milk advertising in Ontario has potential to affect the impact of generic milk advertising. To this end, DFC provided branded milk media investment for Ontario. One should note that the variation in the branded milk media investment in Ontario is stark, with a 600 percent increase between 2009 and 2010.

As with milk, the percent of the product sold under price promotion (TPR) and count of the number of cars crossing into the US from Ontario were also included to capture the impact of price promotion and to control for potential cross-border shopping effects. Figure 14 shows the average TPR (by year) and count of vehicle border crossings for the period 2007-2011. Clearly, the percent of milk sold on price promotion showed variability during the study period, but remains nonetheless low (i.e. 15 percent of volume or less is sold on temporary price reduction). As well, there was a decrease and then increase (beginning in 2009) in the number of same day vehicle traffic over the Ontario-US border over this period. The increase in same day vehicle beginning in 2009 aligns with a period of a strengthening Canadian dollar.

Figure 14: Quarterly average TPR for milk sold in Ontario and same-day vehicle border crossings from Ontario to the US, by year



2.2.3. Maritime Milk Data

The Maritime milk model also included the same four beverages as the Ontario model. Figure 15 shows the average share of total beverage expenditure for these four beverages across 2007-2011. As with Ontario, fluid milk held the large share of beverage expenditure, followed by juices, flavoured soft drinks and dairy alternatives.

Figure 15: Average budget shares for beverages, Maritimes 2007-2011

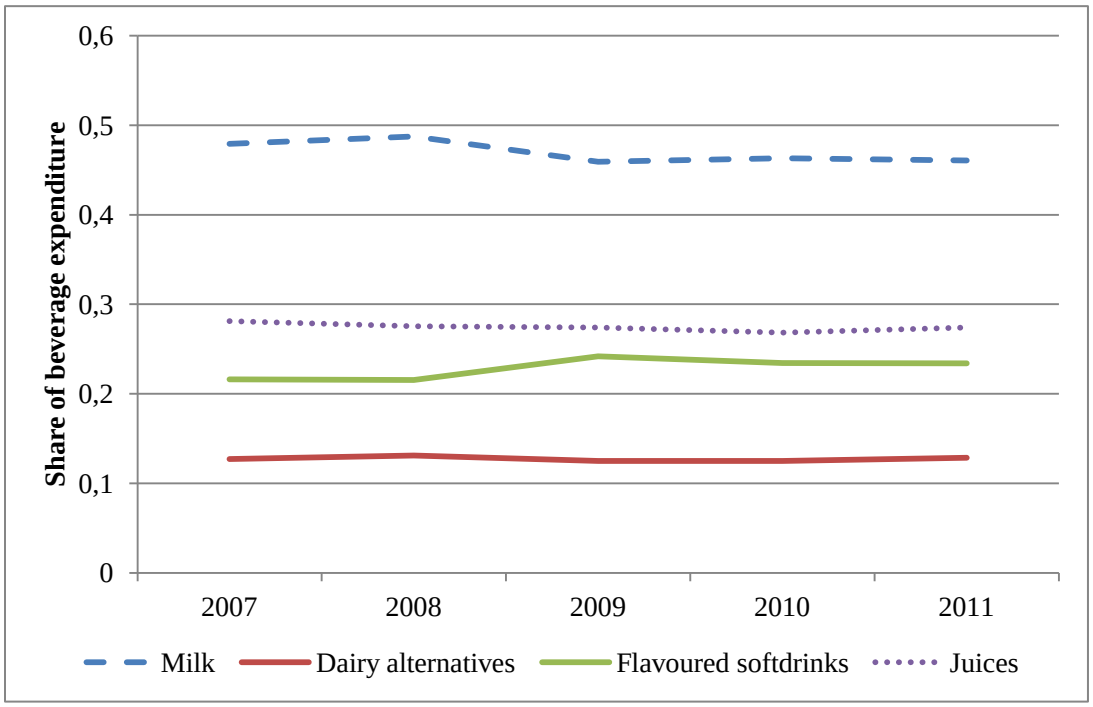


Figure 16 plots average per capita milk demand for the Maritimes (2007-2011) based on data available through the CDIC (since data for the Maritimes is not publically available, the CDIC measures uses the Canadian average) and the Homescan data. As with milk in Ontario, per capita milk consumption in the Homescan data (i.e. in-home) is lower than that report by the CDIC. Recall, however, that Homescan data only captures purchase of milk for consumption in the home, whereas the CDIC data will in and out-of-home milk consumption. Per capita milk purchases in the Homescan data for the Maritimes shows a slight downwards trend between 2007 and 2011.

Figure 16: Average annual per capita milk consumption, Maritimes 2007-2011

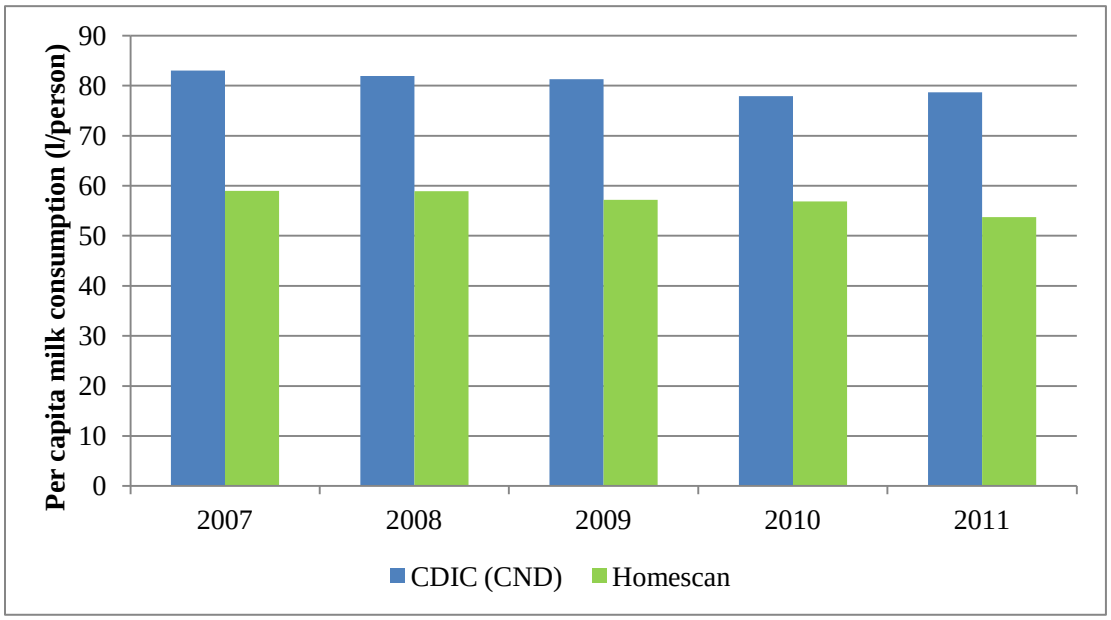
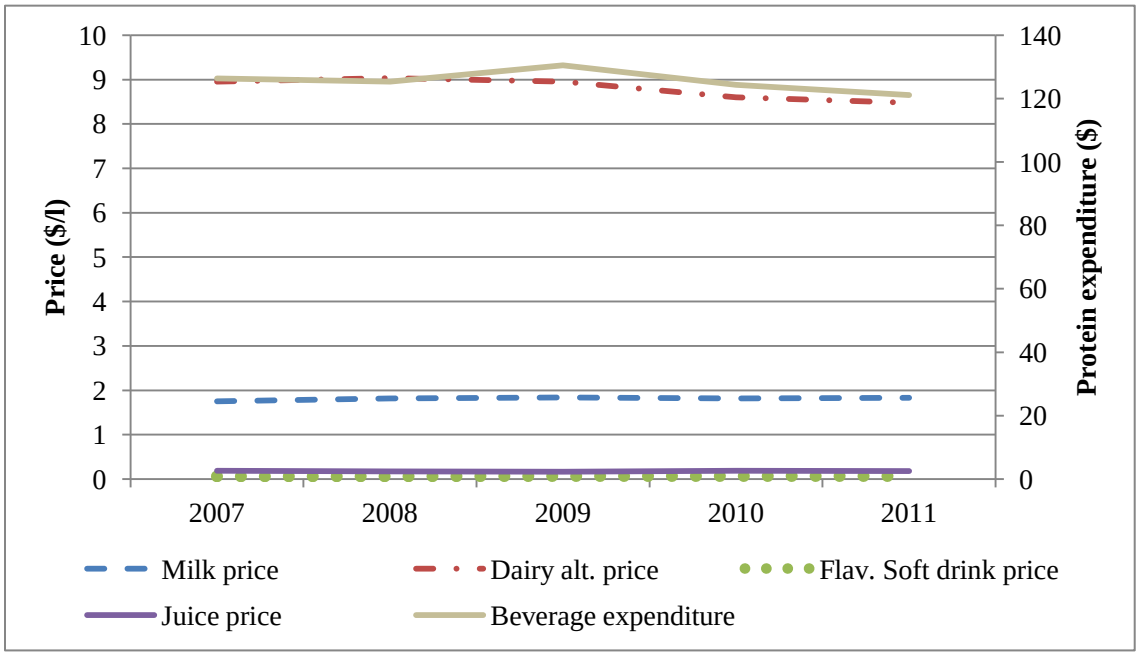


Figure 17 shows averages of the unit price for the four beverages, and total beverage expenditure in the Maritimes. On average, the unit price for dairy alternatives was very high over the study period, followed by the price of fluid milk, juices and flavoured soft drinks. While total expenditure on beverages was relatively constant up to 2009, it declined thereafter. What is interest is that the price of dairy alternatives also began to fall in 2009 – suggesting that pressure on dairy sales might emerge if this trend continues.

Figure 17: Average prices for milk, dairy alternatives, flavoured soft drinks and juices, and total beverage expenditure, Maritimes 2007-2011



Like with cheese and milk in Ontario, it is useful to understand differences in household characteristics (for further household characteristics related to consumption see the Appendix). Figure 18, 19 and 20 show household milk consumption across household income, the presence of children of varying ages in the home and the life-stage variable, respectively. Figure 18 shows a positive relationship between household income and quantity of household milk purchases. Figure 19 shows that households with children under the age of 18 purchase more milk per quarter than households with no children under the age of 18. And, regardless of whether there is one or more children under 18 in the home, the quantity of milk purchased by the household increases with the presence of children of progressively higher ages. For instance, a household with a child between the ages of 13 and 17 will purchase more milk than a household with children under 13 years of age.

Figure 18: Average (2007-2011) Maritime household milk purchases, by household income

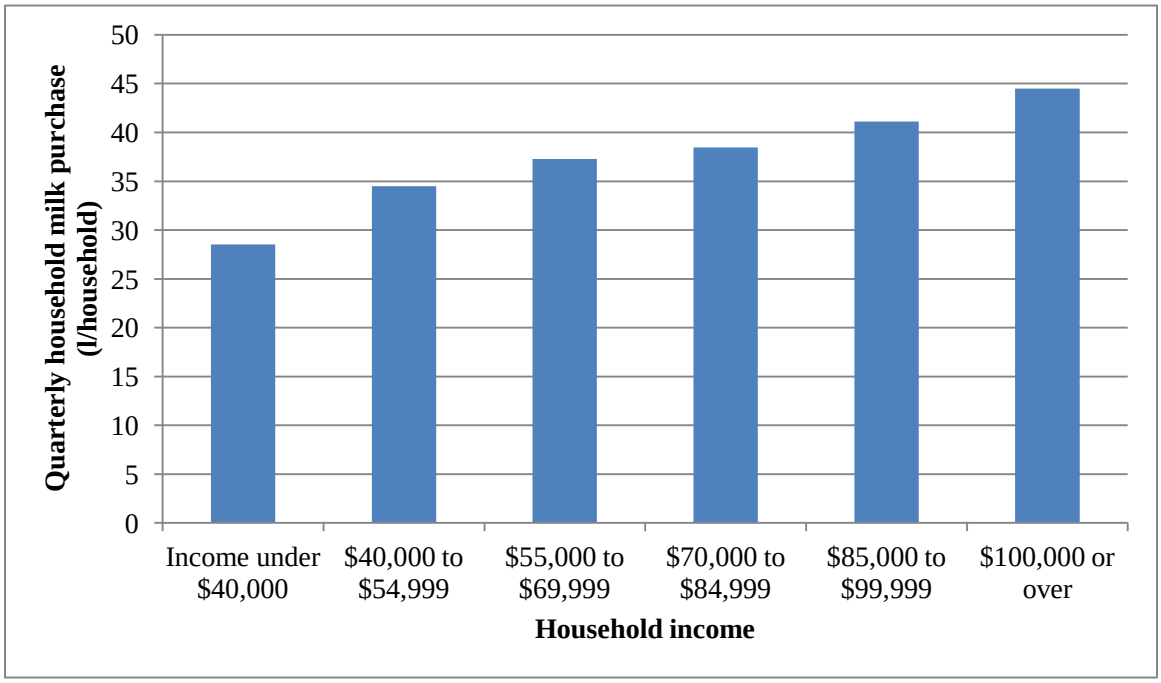


Figure 19: Average (2007-2011) Maritime household milk purchases, by presence of children in the home

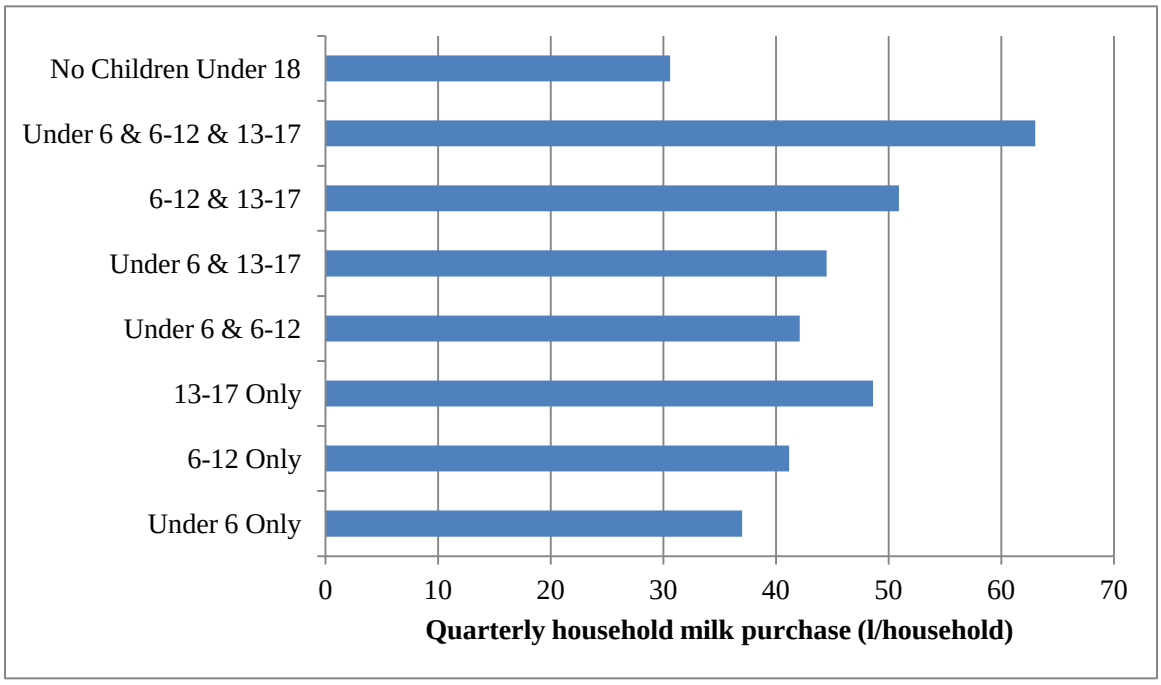
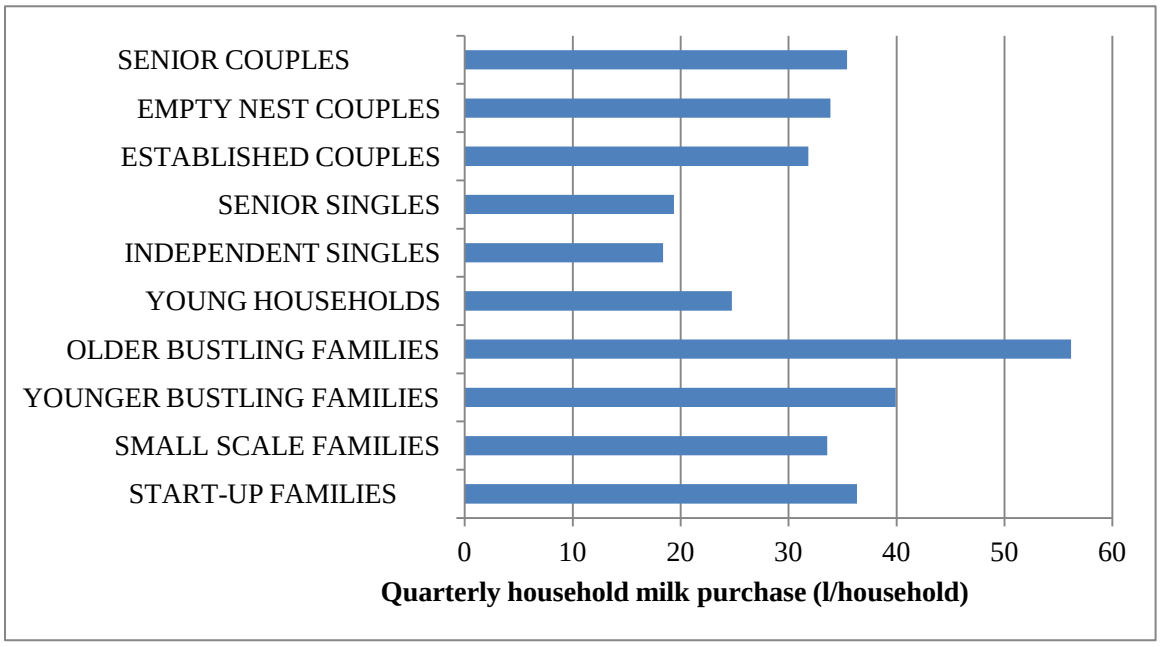


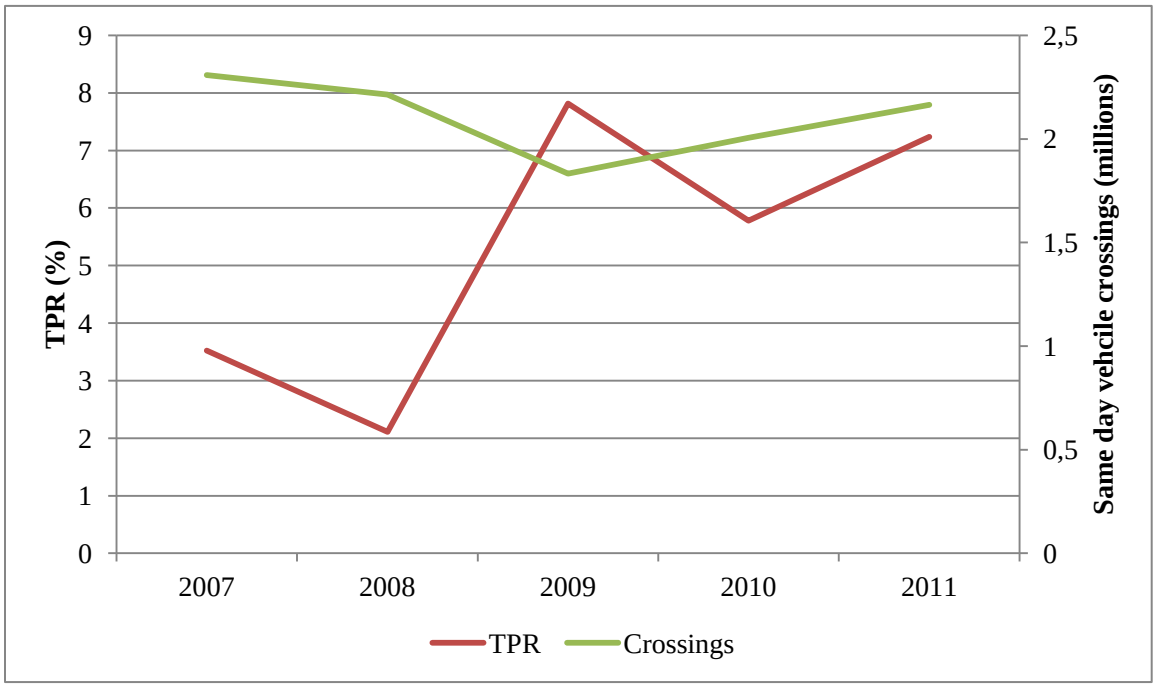
Figure 20 shows that households with single individuals or younger households purchased the least amount of milk, while bustling households purchased the greatest amount of milk, and households with couples or small scale and start-up families were in between these two groups in terms of quantity of milk purchased.

Figure 20: Average (2007-2011) Maritime household milk purchases, by life-stage



Since the data for DFC investment in milk advertising, promotion and nutrition communication is common to Ontario and the Maritimes, it is not discussed here. However, the impact of branded milk advertising in the Maritimes has potential to affect the impact of generic milk advertising. To this end, branded milk media investment in the Maritimes was taken into account. Lastly, Figure 21 shows the quarterly average TPR and count of vehicle border crossings for the period 2007-2011 for the Maritimes.

Figure 21: Quarterly average TPR for milk sold in the Maritimes and same-day vehicle border crossings from the Maritimes to the US, by year



To provide a better frame of reference, the technical appendix includes the mean value, by year, for the variables contained in the cheese model and both milk models.

3. RESULTS

Results from the econometric estimation of the cheese and fluid milk demand models are discussed below. Attention focuses on significance of the variables included in the models and estimates of the elasticities of demand.[4] Given the focus of the analysis is on cheese and fluid milk, discussion focuses on results for these goods.

[4] Given that some households do not consume cheese or milk, account was taken of potential sample selection bias using a two stage approach (see Tauchmann 2005 and literature therein) using household characteristics in the first stage probits and the inverse mills ratios from the first stage in the subsequent demand system estimation.

3.1. Cheese Demand Model

Estimates of the cheese demand model are provided in Table A.4 in the technical appendix. It is important to recognize that since a non-linear AIDS model was estimated, that the coefficients in Table A.4 do not tell us what impact the relevant variable had on quantity demanded. Nonetheless, of the 24 estimated parameters, 15 were significantly different from zero at ten percent level or better, suggesting the estimated model carried significant explanatory power. Note that conventional measures of goodness-of-fit (i.e. r^2) are not appropriate in a demand system setting, and that existing system-r^2 measures tend to overstate how well the estimated model fits the data. As such, we rely on the overall significance of the estimated model. In this respect, note that the null hypothesis that the estimated coefficients in the cheese model were jointly equal to zero (i.e. carried no explanatory power) was rejected at the one percent level.[5]

Statistically significant coefficient estimates were measured for the following variables: cheese price, protein expenditure, nutrition communication, TPR, whether the household had a married couple, household size, whether the household head was under 35 years of age, whether the household head was over 50 years of age, whether there were no children in the home, seasonal factors for quarter 1 and 4, and regional dummy variables. It is noteworthy that the count of the number of single-day vehicle trips across the Canada-U.S. border did not have a statistically significant coefficient estimate. While the coefficients on generic advertising and promotion where not statistically significant, this does not mean investment in these activities had no effect, rather it means that these coefficients are not estimated with as high a degree of precision as the other estimates in the cheese model.

To put the estimates in an economic context, the elasticity of cheese demand with respect to: the economic variables, DFC investment variables and other marketing variables, were calculated for each household in each time period. As over 100,000 observations were used for estimation, it is impossible to explore these elasticities at a household level. Instead, Table 1 reports the average value of the elasticities and the subsequent figures plot the average value of key elasticities in each year of the study period. The own-price cheese demand elasticity is negative and significant, and indicates cheese demand is inelastic (but only just so). The cross-price elasticity of cheese demand with respect to meat is positive and significant, indicating cheese and meat are substitute goods. This cross-price elasticity indicates that as the price of meat increases, people substitute away from meat towards cheese. The elasticity of cheese demand with respect to protein expenditure is also positive and significant, but inelastic, again indicating cheese demand does not respond as strongly to protein expenditure changes as it

[5] A likelihood ratio test was used to test this hypothesis.

does to own-price (i.e. a 1% increase in protein expenditure leads to a 0.67% increase in cheese demand).[6]

These price and expenditure elasticities are generally similar to those reported in our earlier analysis (in 2007 and 2010). Note, however, that the own-price elasticity of demand is less inelastic (suggesting cheese demand is more responsive to cheese price) in this analysis than in the 2007 and 2010 reports, while the cross-price elasticity with respect to meat suggests a substitute relationship in this analysis, but was previously measured to have a complementary relationship. It is important to note that since the present analysis only includes the in-home channel, comparison of the econometric results to our earlier work (which included the in-home and food-service channel) should be undertaken with care.

Table 1: Average value of key cheese demand elasticities

Variable	Elasticity
Cheese price	-0.983***
Meat price	0.308***
Protein expenditure	0.674***
Generic advertising	0.0002
Promotion	0.0121
Nutrition communication	0.0097**
Branded cheese advertising	0.0086
TPR	0.1131**

*** - significant at the one percent level

** - significant at the five percent level

The elasticities of cheese demand with respect to generic advertising[7] and promotion investment are both positive but not significant, while the elasticity with respect to nutrition communication is positive and significant. Amongst these DFC investment activities, cheese demand appears most responsive to promotion, followed by nutrition communications and then generic advertising. Interestingly, the elasticity of cheese demand with respective to branded cheese advertising is positive (but not significant), indicating that increases in branded media investment increases demand for cheese. Lastly, the elasticity of cheese demand with respect to TPR is positive and significant, and also large in comparison with the marketing elasticities. This would suggest that cheese demand is quite responsive to price promotion compared to the generic advertising, promotion, nutrition communication and branded advertising effects.

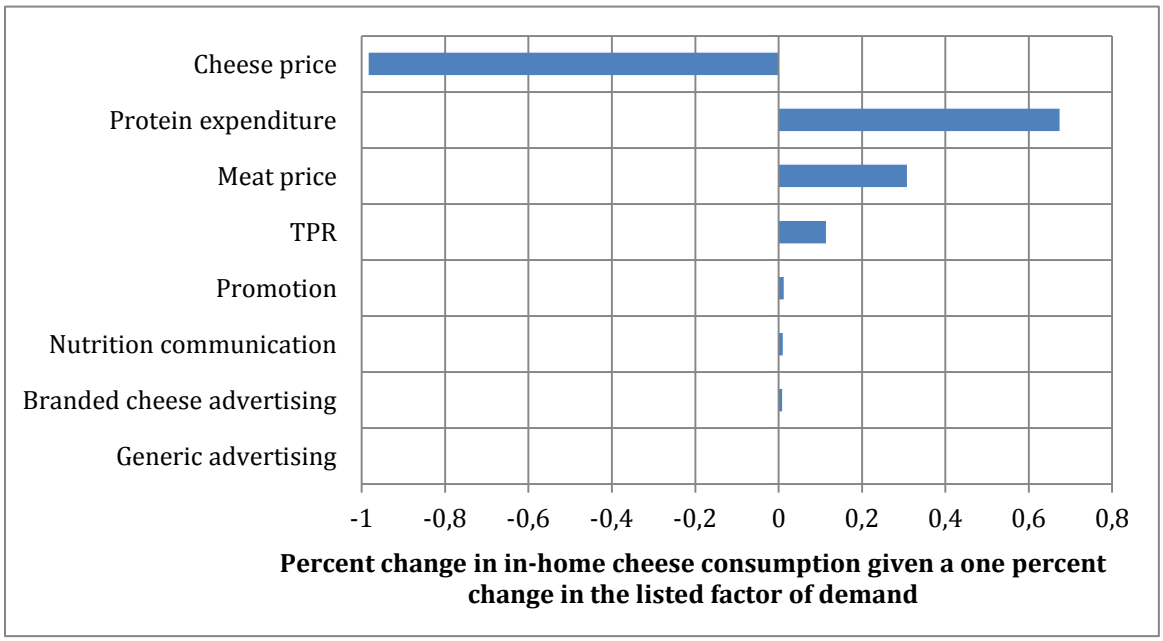
[6] The cheese model was also estimated using total food expenditure in place of protein expenditure. While the precise value of the estimated coefficients was different (as to be expected), the signs, magnitude and qualitative conclusions regarding the elasticities reported here remained unchanged.

[7] Generic advertising in the Canada cheese model was included with a one-quarter lag, a reflection of the wear-out effect common with advertising activity. This lag provided the best overall fit of the model.

Compared to results from our analysis undertaken in 2007 and 2010, there appears to be some changes in the elasticities with respect to marketing activities. Cheese demand is less responsive to DFC investment in advertising than in our previous analysis, but is more responsive to promotion activities. Note that since we did not explicitly include nutrition communication in the previous analysis, we have no basis of comparison to our past analysis. Again, care must be taken in comparing these results to previous analysis, as we focus only on the in-home channel in this study.

It appears from the model results that consumption of cheese during the study period was most strongly affected by the price of cheese, followed by expenditure on protein sources, the price of meat, TPR, promotion, nutrition communication, branded cheese advertising and lastly, generic cheese advertising. To illustrate the effect of a one-percent change in any one of these variables, Figure 22 plots these elasticities from those having the greatest effect to those having the least effect. The figure shows the impact on cheese consumption given a one-percent change in anyone of the listed variables. For instance, a one percent increase in the price of cheese, would lead to a 0.98 percent *decrease* in cheese consumption in the home.

Figure 22: Plot of the cheese demand elasticities in Table 1.



Recall that the calculated elasticities vary of time. To help understand whether these elasticities have changed over the study period, Figure 23 plots the average value of the price and expenditure elasticities for cheese, by year. The own-price elasticity of cheese, shown using the scale on the left axis, becomes less negative over the study period, suggesting that cheese demand has become more inelastic with respect to cheese price. The cross-price and expenditure elasticities shown in Figure 23 point to subtler changes in both, although the elasticity of cheese demand with respect to meat price has fallen over the study period.

Figure 23: Average value of cheese's elasticity of demand with respect to cheese price (left axis), meat price (right axis) and protein expenditure (right axis)

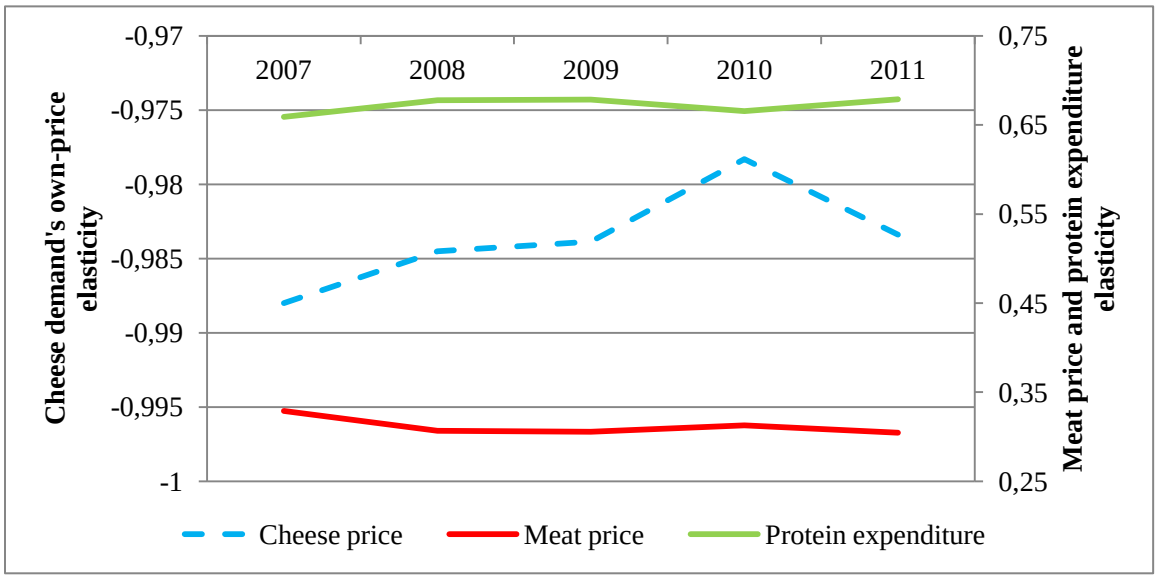


Figure 24 plots the average values of the elasticity of cheese demand with respect to DFC marketing investment, brand advertising, while figure 25 plots the elasticity for TPR. The small magnitude of the generic advertising elasticity makes it hard to see a slight decreasing trend between 2007 and 2011. As well, we can see slight reductions in the promotion, nutrition communication and branded advertising elasticities over this timeframe. In contrast, the TPR elasticities increased in value between 2007 and 2011.

Figure 24: Average value of cheese's elasticity of demand with respect to generic advertising, promotion, nutrition communication and brand advertising

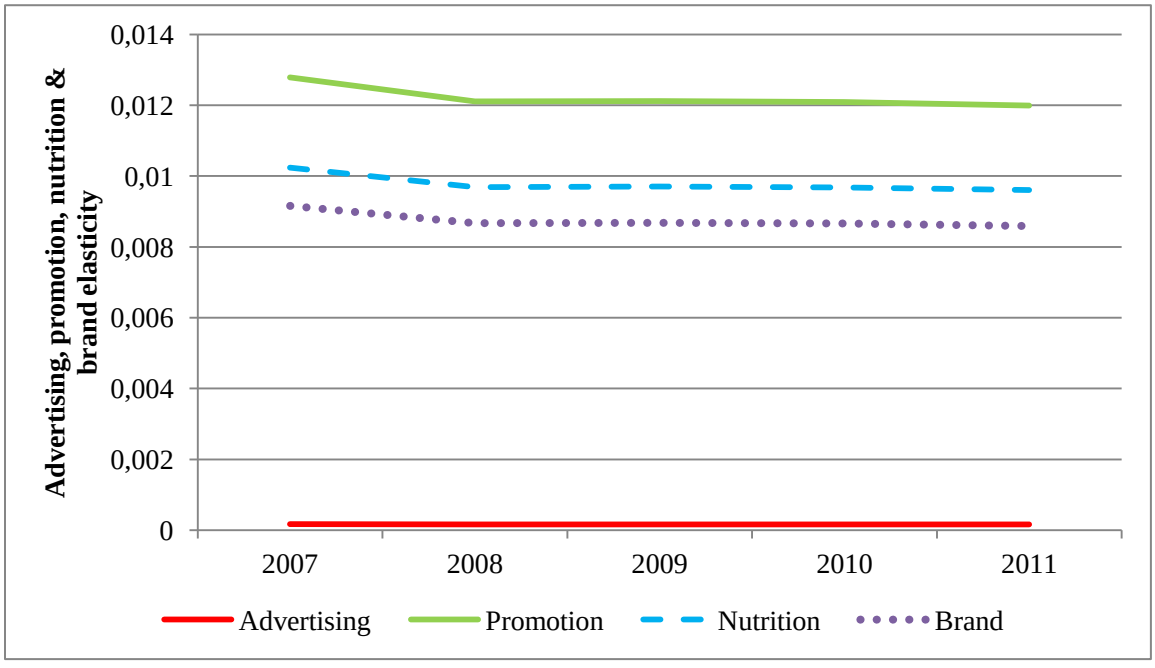
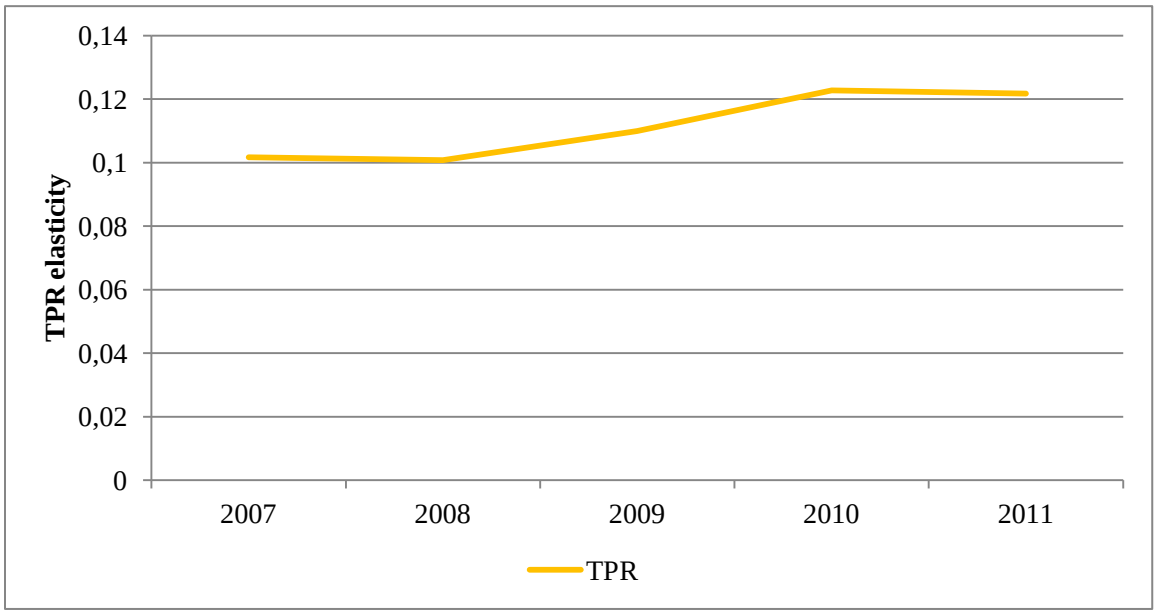


Figure 25: Average value of cheese's elasticity of demand with respect to TPR



3.2. Ontario Milk Demand Model

Initial efforts to estimate the Ontario milk demand model using the Translog price index for P* in equation (1) led to technical difficulties (i.e. the model would not converge). Despite numerous efforts to overcome this issue, corrections would not work. Consequently, Stone's price index was used in place for P* in equation (1). In addition to this, further difficulties were encountered when trying to include the full set of non-economic characteristics in the Ontario milk demand model. As such, the Ontario model does not include all of the household and seasonal variables. It should be noted that similar difficulties were encountered when modeling demand for milk in Ontario in our previous evaluation efforts. Given that these previous evaluations used different data than the present evaluation, this suggests that the Ontario non-alcoholic beverage market is a difficult market in which to capture demand's response to elements of a marketing mix; this is likely an outcome of the competitive environment in Ontario (e.g. large population, numerous media outlets, including those from the U.S., making difficult for a message to reach the target audience).

Table A.5 shows the estimated parameters in the Ontario beverage model. Of the 42 estimated coefficients, 30 were significant at the ten percent level or better. As well, the null hypothesis that the estimated coefficients were jointly equal to zero (i.e. the model carried no explanatory power) was rejected at the one percent level. In the milk equation of the Ontario beverage model, statistically significant coefficient estimates were measured for the following variables: milk price, price of dairy alternatives, price of flavoured soft drinks, beverage expenditure, DFC promotion, nutrition communication, branded milk advertising in Ontario, whether a language other than English was spoken in the home, whether the household had a married couple, and

the time trend (year). Note that the count of the number of single-day vehicle trips across the Ontario-U.S. border did not have a statistically significant coefficient estimate, nor did TPR. Lack of a significant effect of cross-border trips may seem counter-intuitive to some. However, it is important to bear in mind that unlike some regions of Canada (e.g. the lower mainland of B.C.), the large population in southern Ontario is spread over a larger geographic base and in a manner that makes it less convenient to cross the border for a single day shopping event.

Table 2 reports the average value of the price, expenditure and marketing elasticities. The own-price milk demand elasticity is negative and significant, and indicates milk demand in Ontario is elastic. While this elasticity is different from what we have reported previously (these have been inelastic own-price effects), it is not uncommon for one to estimate elastic demands at the household level, despite inelastic demands at the aggregated market level (Kohls and Ulh 1998). Moreover, this analysis only considers the in-home channel, while the previous analysis considered in-home and food-service channels, with differences in price sensitivity across these two channels being a further explanation for differences compared to previously reported results,

Table 2: Average value of key milk demand elasticities for Ontario

Variable	Elasticity
Milk price	-1.303***
Dairy alternative price	0.185***
Flavoured softdrink price	0.073***
Juice price	0.043***
Beverage expenditure	-1.060***
Generic advertising	0.0076
Promotion	0.0382***
Nutrition communication	0.0157**
Branded milk advertising	0.0201***
TPR	0.0236

*** - significant at the one percent level

** - significant at the five percent level

The cross-price elasticities of milk demand with respect to the related beverages are all positive and significant, indicating these products are substitutes for milk in the eyes of Ontario households in the sample. Moreover, the cross-price elasticities are all small in comparison to the own-price effect, indicating the latter dominates when prices change. Similar cross-price results were reported in our previous analysis. The elasticity of milk demand with respect to beverage expenditure is significant but negative, indicating that as beverage expenditure grows demand for milk falls. This means that as household expenditure on beverages increases, they

purchase less milk, but more of other beverages. While Figure 11 showed Ontario household purchases of milk grew across higher household income categories, it is important to remember that Figure 11 did not account for the role of prices and marketing activities, whereas the elasticities are calculated based off a model that accounts for these other factors. Once factored into the analysis, and compared to beverage expenditure, we see an inverse relationship between milk demand and beverage expenditure.[8]

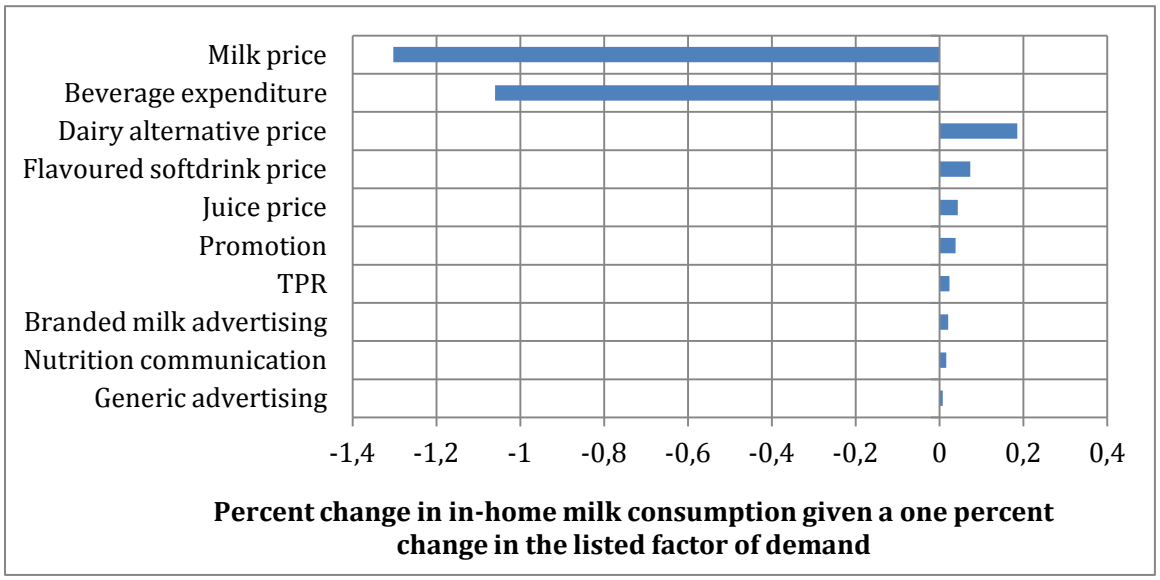
The elasticity of milk demand with respect to generic advertising[9] is positive, but not significant, while the elasticities with respect to promotion and nutrition communication are positive and significant. Amongst these DFC investment activities, milk demand in Ontario appears most responsive to promotion, followed by nutrition communication and then generic advertising. Moreover, compared to our previous analysis (in 2005 and 2010), the generic advertising appears less effective in increasing demand, while promotion is more effective. The elasticity of milk demand with respect to branded milk advertising is positive and significant indicating that branded efforts can increase milk demand. Lastly, the elasticity of milk demand with respect to TPR is positive but not significant

It appears from the model results that in-home consumption of fluid milk in Ontario was most strongly affected by the price of milk, followed by expenditure on beverages, the price of dairy alternatives, the price of flavoured softdrinks, the price of juice, milk promotion activities, TPR, branded milk advertising, nutrition communication and lastly, generic milk advertising. To illustrate the effect of a one-percent change in any one of these variables, Figure 26 plots these elasticities from those having the greatest effect to those having the least effect. The figure shows the impact on in-home consumption of milk in Ontario given a one-percent change in anyone of the listed variables.

[8] As with the cheese model, the Ontario milk model was re-estimated using total food expenditure in place of beverage expenditure. And, as with cheese, the results with total food expenditure as the expenditure term were not qualitatively different than those reported here.

[9] Promotion in the Ontario milk model was included with a one-quarter lag. This lag provided the best overall fit of the model.

Figure 26: Plot of the milk demand elasticities (for Ontario) in Table 2.



To help understand whether these elasticities have changed over the study period, Figure 27 plots the average value of the price and expenditure elasticities for milk, by year. The own-price elasticity of milk (as well as the elasticity with respect to beverage expenditure, both of which are shown using the scale on the right axis), shows some variation overtime, but there does not appear to be a strong trend. The cross-price elasticities shown in Figure 27 appear to be increasing overtime, suggesting milk demand in Ontario has become more sensitive to the price of substitute goods. This suggests that over the time period considered, these other beverages are seen as more of a substitute to milk, with dairy alternatives seen as a much stronger substitute for milk compared to the other beverages.

Figure 27: Average value of milk's elasticity of demand with respect to substitute good's prices (left axis) and own-price and beverage expenditure (right axis), Ontario

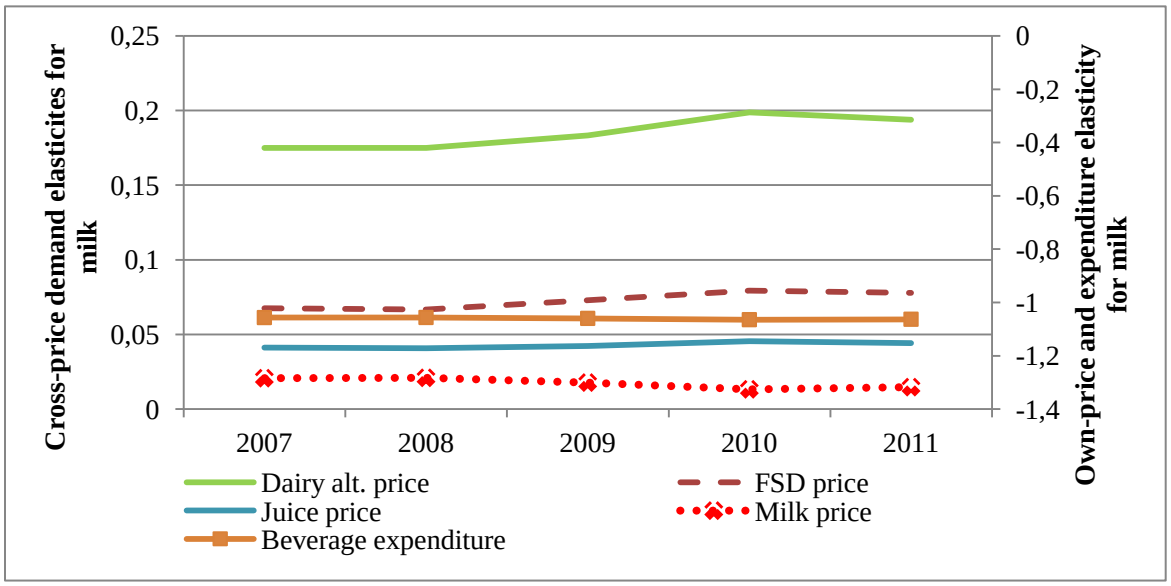


Figure 28 plots the average values of the elasticity of milk demand in Ontario with respect to DFC marketing investment, brand advertising, while figure 29 plots the TPR elasticity. Between 2007 and 2011, the elasticities of milk demand in Ontario with respect to DFC investment activities have grown; milk demand became more responsive to DFC generic advertising, promotion and nutrition communication efforts. Note too that the impact of brand advertising also increased, and that brand advertising was more effective in shifting demand than DFC investment in generic advertising and nutrition communication. It is important, however, to bear in mind that brand investment only includes media costs, it does not include production costs, and as such the brand effect might overstate the true effect were branded production costs available to us. Lastly, note that milk demand became more responsive to the TPR variable (see figure 29), suggesting that between 2007 and 2011, households in Ontario increased their milk demand in response to price promotion.

Figure 28: Average value of milk's elasticity of demand with respect to generic advertising, promotion, nutrition communication and brand advertising, Ontario

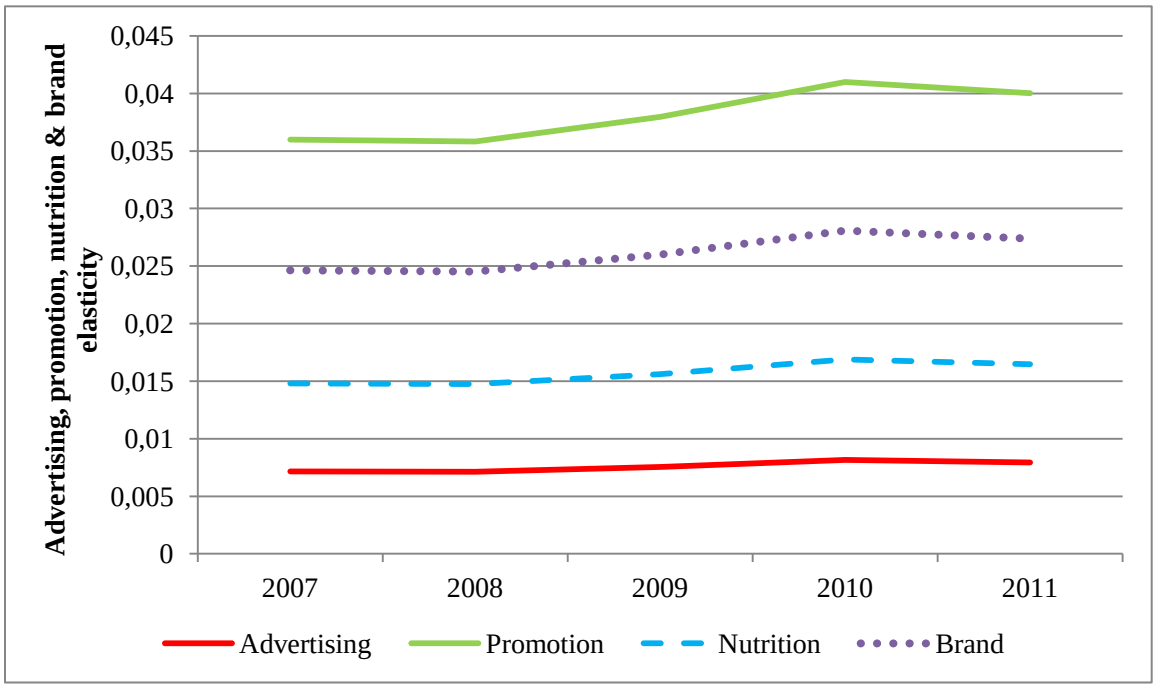
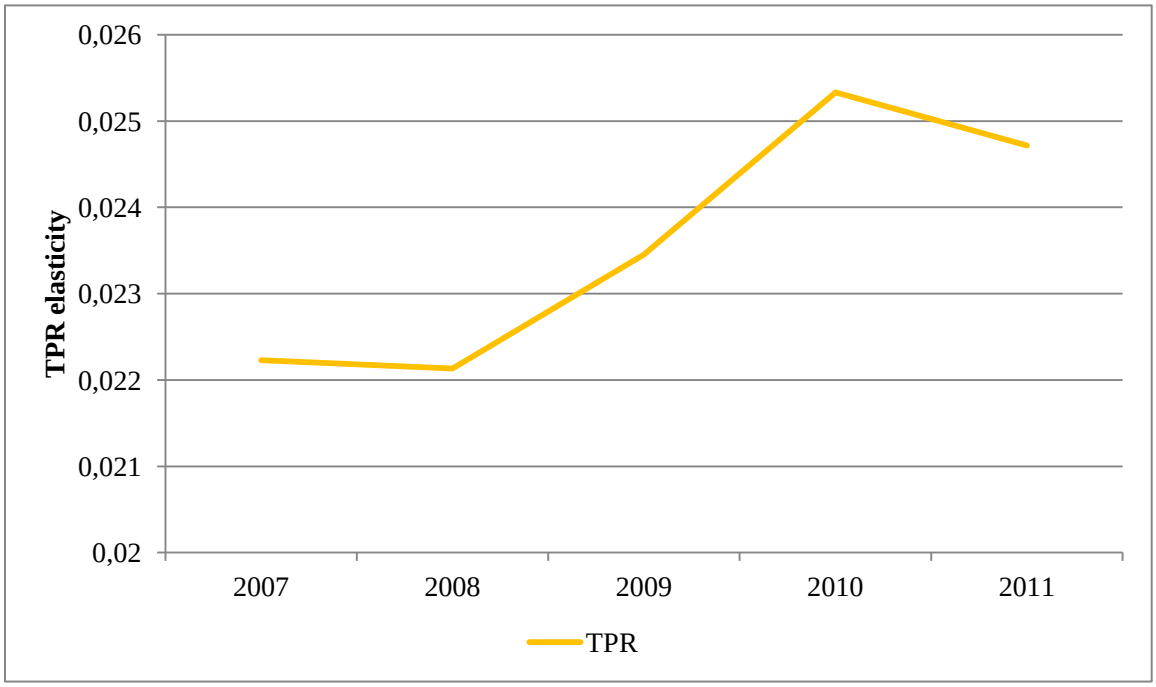


Figure 29: Average value of milk's elasticity of demand with respect to TPR, Ontario



3.3. Maritime Milk Demand Model

Table A.6 shows the estimated parameters in the Maritime beverage model. Of the 63 estimated parameters, 29 were significant at the ten percent level or better. The null hypothesis that the estimated coefficients were jointly equal to zero (i.e. the model carried no explanatory power) was rejected at the one percent level. In the milk equation of the Maritime beverage model, statistically significant coefficient estimates were measured for the following variables: the intercept, milk price, price of dairy alternatives, beverage expenditure, DFC promotion, nutrition communication, whether a language other than English was spoken in the home, whether the household had a married couple, household size, and the time trend (i.e. year). Note that the count of the number of single-day vehicle trips across the Maritime-U.S. border did not have a statistically significant coefficient estimate, nor did TPR.

Table 3 reports the average value of the price, expenditure and marketing elasticities. As with Ontario, the own-price milk demand elasticity is negative and significant, and indicates milk demand is elastic. Our previous analysis, undertaken using data from the in-home and food-service channel, indicated milk demand was inelastic, but again, differences in the channel and nature of the data (household versus the entire market) underlie these differences. The cross-price elasticities of milk demand with respect to the price of related beverages are all significant, but have differing signs. The cross-price elasticity with respect to dairy alternatives is positive and elastic, indicating milk and dairy alternatives are substitutes in Maritime households, Moreover, the large size of the cross-price elasticity of milk demand with respect to price of dairy alternatives indicates that demand for milk in the Maritimes is very sensitive to the price of dairy alternatives; a one percent increase in the price of dairy alternatives will lead to a 2.6% increase in demand for milk. The cross-price elasticity of demand for flavoured soft drinks and juices are negative, indicating these goods are complements to milk. This means an increase in the price of flavoured softdrinks or juice will lead to a reduction in milk demand in the Maritimes; a qualitatively similar result was reported in our 2010 analysis. Unlike the Ontario model, the elasticity of milk demand with respect to beverage expenditure is positive and significant, indicating that a one percent increase in household expenditure on beverages leads to a 1.16% increase in milk demand.[10] The expenditure elasticity also tells us that the same one percent increase in household expenditure on beverages would lead to less than a one percent increase in demand for other beverages (and possibly even a decrease in demand for other beverages).

[10] Just like the Ontario milk model, results for the Maritime milk model were not qualitatively different when total food expenditure was included in place of beverage expenditure.

Table 3: Average value of key milk demand elasticities for the Maritimes

Variable	Elasticity
Milk price	-1.403***
Dairy alternative price	2.624***
Flavoured softdrink price	-0.036***
Juice price	-0.153***
Beverage expenditure	1.164***
Generic advertising	0.0059
Promotion	0.0723***
Nutrition communication	0.0309**
Branded milk advertising	-0.0123
TPR	0.0076

*** - significant at the one percent level
** - significant at the five percent level

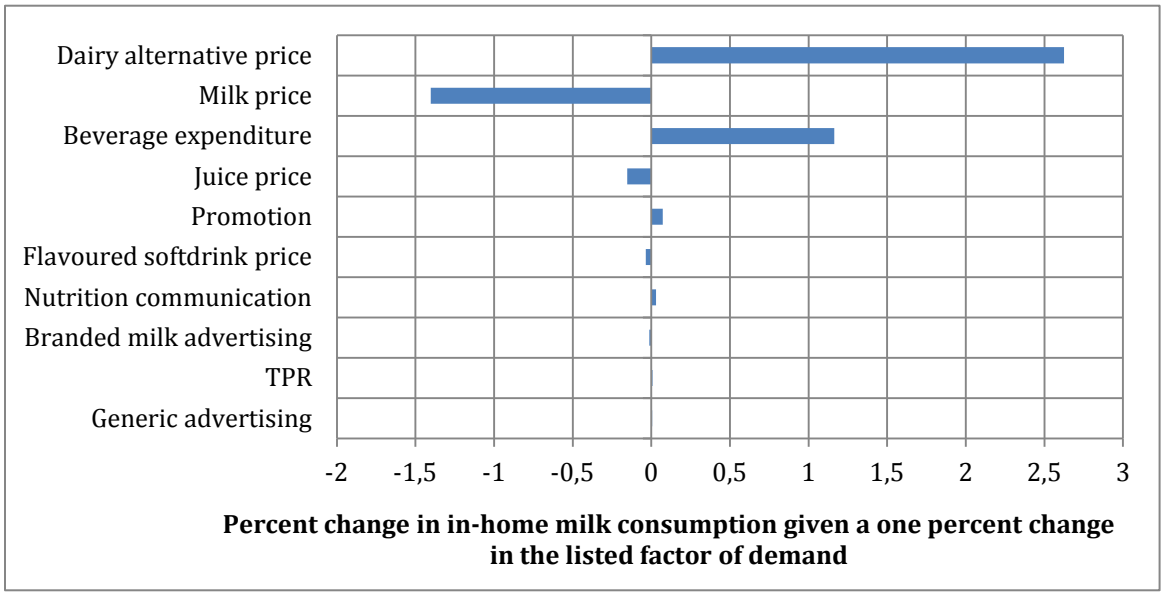
The elasticity of milk demand with respect to generic advertising is positive[11], but not significant, while the elasticities with respect to promotion and nutrition communication are positive and significant. Amongst these DFC investment activities, milk demand in the Maritimes is most responsive to promotion, followed by nutrition communication and then generic advertising. The elasticity of milk demand with respect to branded milk advertising is negative but not significant, indicating that branded milk advertising efforts did not affect demand for milk in the Maritimes during the study period. Compared to results from our analysis undertaken in 2005 and 2010, there appears to be some changes in the elasticities with respect to marketing activities. Milk demand in the Maritimes is less responsive to DFC investment in advertising than in our previous analysis, but is more responsive to promotion activities. Note that since we did not explicitly include nutrition communication in the previous analysis, we have no basis of comparison to our past analysis. Again, care must be taken in comparing these results to previous analysis, as we focus only on the in-home channel in this study. Lastly, the elasticity of milk demand with respect to TPR is positive and but not significant

It appears from the model results that in-home consumption of fluid milk in the Maritimes was most strongly affected by the price of dairy alternatives, followed by the price of milk, expenditure on beverages, the price of juice, milk promotion activities, the price of flavoured softdrinks, nutrition communication, branded milk advertising, TPR and lastly generic milk advertising. To illustrate the effect of a one-percent change in any one of these variables, Figure 30 plots these elasticities from those having the greatest effect to those having the least effect.

[11] Generic advertising in the Maritime milk model was included with a one-quarter lag. This lag provided the best overall fit of the model.

The figure shows the impact on in-home consumption of milk in the Maritimes given a one-percent change in anyone of the listed variables.

Figure 30: Plot of the milk demand elasticities (for the Maritimes) in Table 3.



To help understand whether these elasticities have changed over the study period, Figure 31 plots the average value of the price and expenditure elasticities for milk, by year. The own-price elasticity of milk (as well as the elasticity with respect to beverage expenditure), shown using the scale on the right axis, shows some variation overtime, but, as with Ontario, there does not appear to be a strong trend.

Figure 31: Average value of milk's elasticity of demand with respect to substitute good's prices (left axis) and own-price and beverage expenditure (right axis), the Maritimes

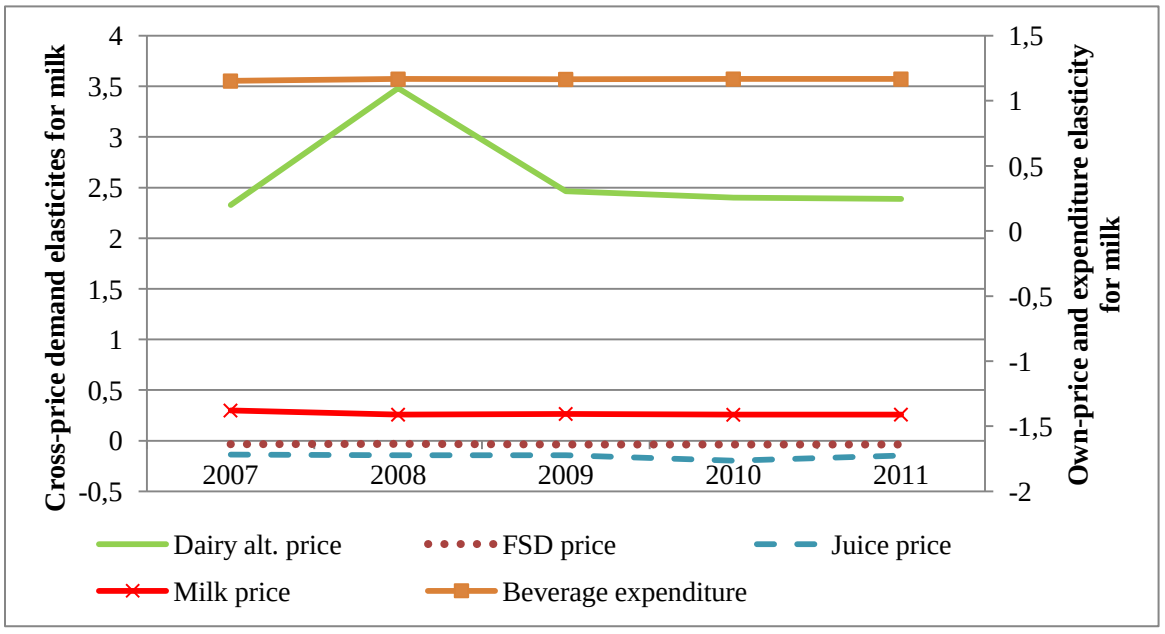


Figure 32 plots the average values of the elasticity of milk demand in Ontario with respect to DFC marketing investment, brand advertising, while figure 33 plots the TPR elasticity. Between 2007 and 2011, the elasticity of milk demand in the Maritimes with respect to DFC investment activities grew slightly, a result that is more pronounced for promotion. While the TPR elasticity increased over the study period, there was considerable year-to-year variation. This variation is a result of considerable the year-to-year in the TPR in the Maritime milk market during the study period (see Table A.3).

Figure 32: Average value of milk's elasticity of demand with respect to generic advertising, promotion, nutrition communication and brand advertising, the Maritimes

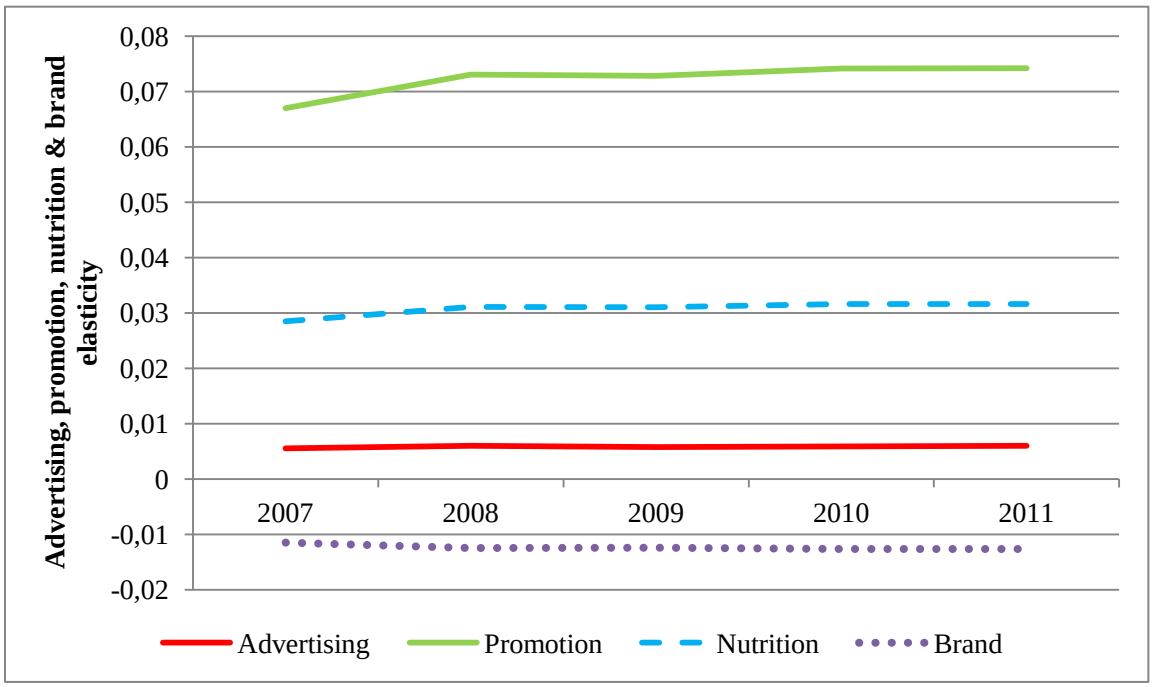
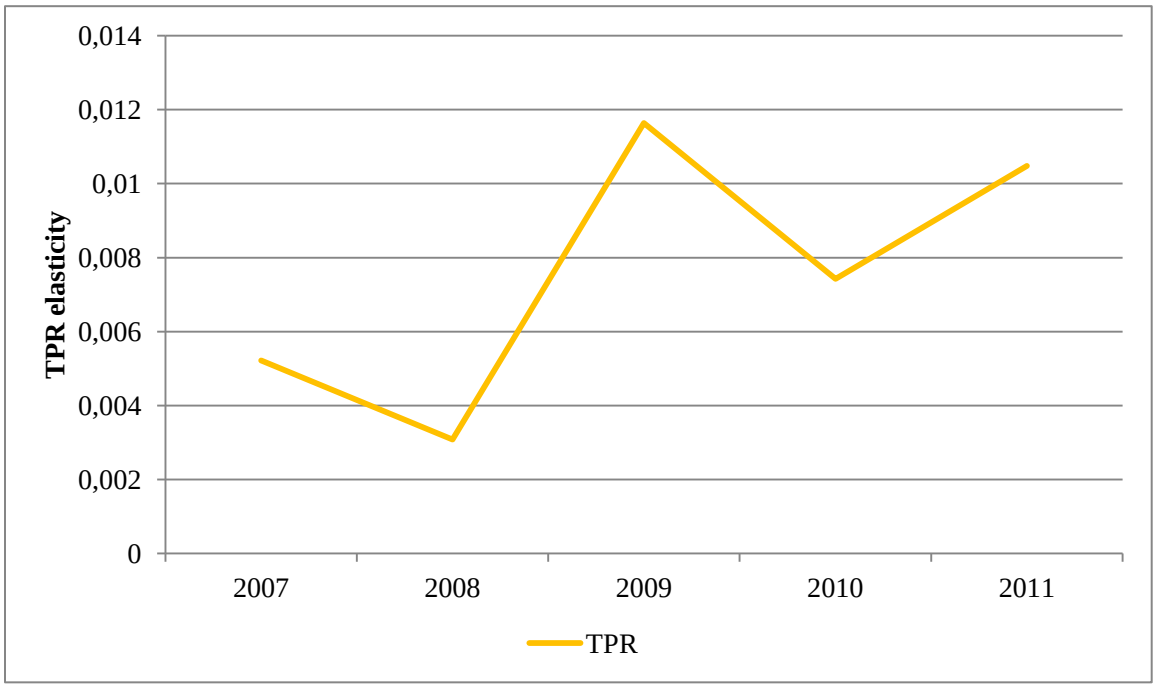


Figure 33: Average value of milk's elasticity of demand with respect to TPR, the Maritimes



3.4. Auxilary regression analysis

While the results above are the focus of the analysis, some technical issues prevented inclusion of some demographic and household characteristics in the estimated demand systems. To overcome this issue, single equation models of household demand for the three products (i.e. a national cheese demand model, a milk demand model for Ontario, and a milk demand model for the Maritimes) were estimated. These single equation models regress household demand for the respective product on the prices of the goods included in the demand system analysis, the marketing variables (i.e. DFC investment in advertising, promotion and nutrition communication, and branded media cost), TPR, the count of single day border crossings, a time trend and seasonal dummy variables. More importantly, these models also include characteristics of the household, including: a dummy variable indicating whether the household speaks a language other than English, a dummy variable indicating whether the household includes a married couple, household size, a set of dummy variables indicating the age of the household head, and dummy variables for the province in which the household resides. Added to this are two sets of dummy variables not included in the demand system analysis. The first are dummy variables indicating the range of household income. Understanding how consumption of the relevant product varies across households with different income ranges will helps show how broader economic factors affect demand. The second are dummy variables indicating whether children under the age of 12 are in the household and whether children between the ages of 13 and 17 are in the home. As the latter were squarely in the marketing plan for DFC over the study period, understanding how the presence of children in these age

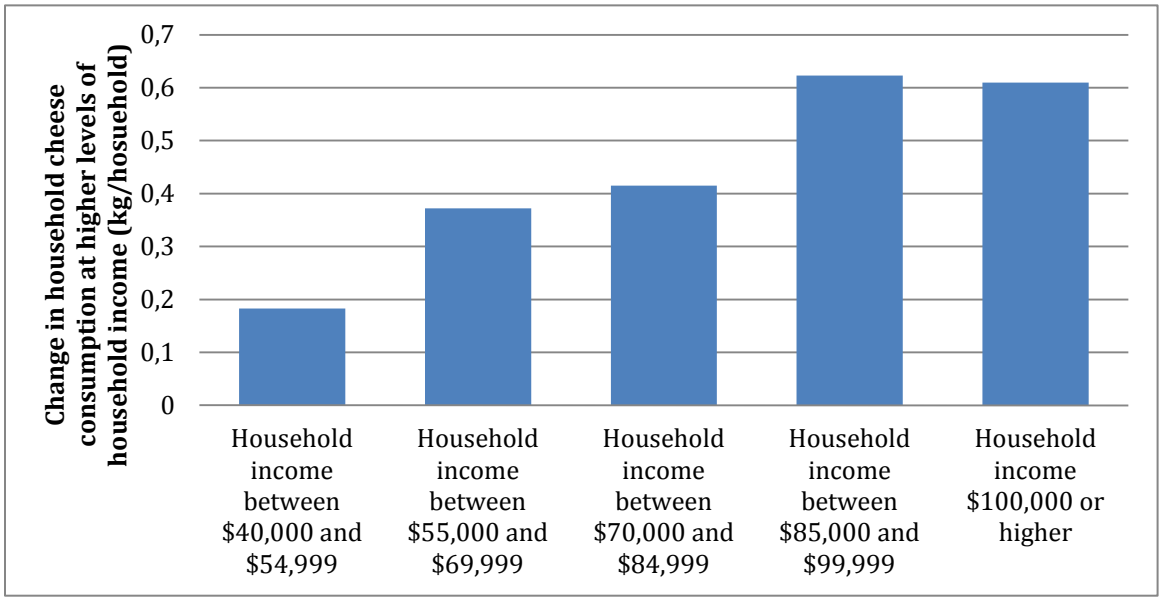
groups in the home affects the household's demand will address an important question insofar as program effectiveness is concerned.

3.4.1. Cheese model

Results for the national cheese model (see columns 2 and 3 in Table A.7) show that the only significant regional dummy was for the Maritimes. Given Ontario is the omitted region for this set of dummy variables, this tells us that during the study period, household cheese consumption was not statistically different amongst the Canadian provinces that were part of the analysis, but for the Maritimes where household consumption is roughly 0.6 kg lower. Results also show that compared to households where English was spoken (the omitted group for the language dummy), households where some language other than English was spoke had lower cheese consumption. Households with married couples had higher cheese consumption compared to the omitted group of households without married couples. While this result might reflect household size, recall that the model included the size of the household. Indeed, the coefficient on the household size variable shows that household cheese consumption increased with household size. In addition to this, households where the head of household was under 35 years of age had lower cheese consumption compared to households with a head aged between 35 and 49 years of age. Looked at another way, households where the head was between 35 and 49 years of age had higher cheese consumption than households with younger aged heads.

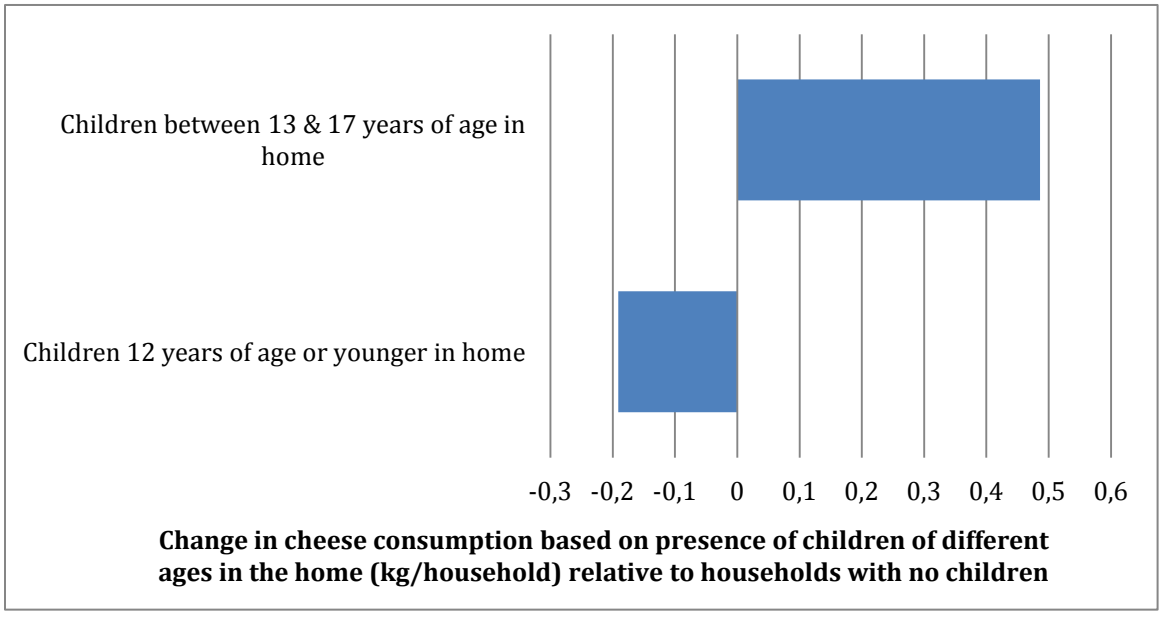
Perhaps more interesting was the fact that household cheese consumption increased with household income. Using households with under $40,000 in household income as the reference group, the significant coefficients on the household income variables indicate that as a household moves to progressively higher income categories, as the household's cheese consumption increases. These coefficients are highly significant, and are plotted in Figure 34. It is important to note that these coefficients are net of the effect of other variables in the model (i.e. these plotted coefficients isolate the effect of income). One interpretation of this effect is that economic downturns that lower household income, such as the 2008 recession, will lead to reduced cheese consumption.

Figure 34: Plot of the household income dummy variable coefficients in the national cheese model (the omitted group are households with income under $40,000)



In addition to this, coefficients on the dummy variables for households with children of different ages are also significant. In particular, and relative to the omitted group, which are households with no children under the age of 18, households with children under 13 years of age consumed significant less cheese. However, households with children between the ages of 13 and 17 had significantly higher cheese consumption during the study period than households with no children. It should be noted that both of these effects are highly significant (for reference they are plotted below in figure 35), and are net of the effect of other variables in the model.

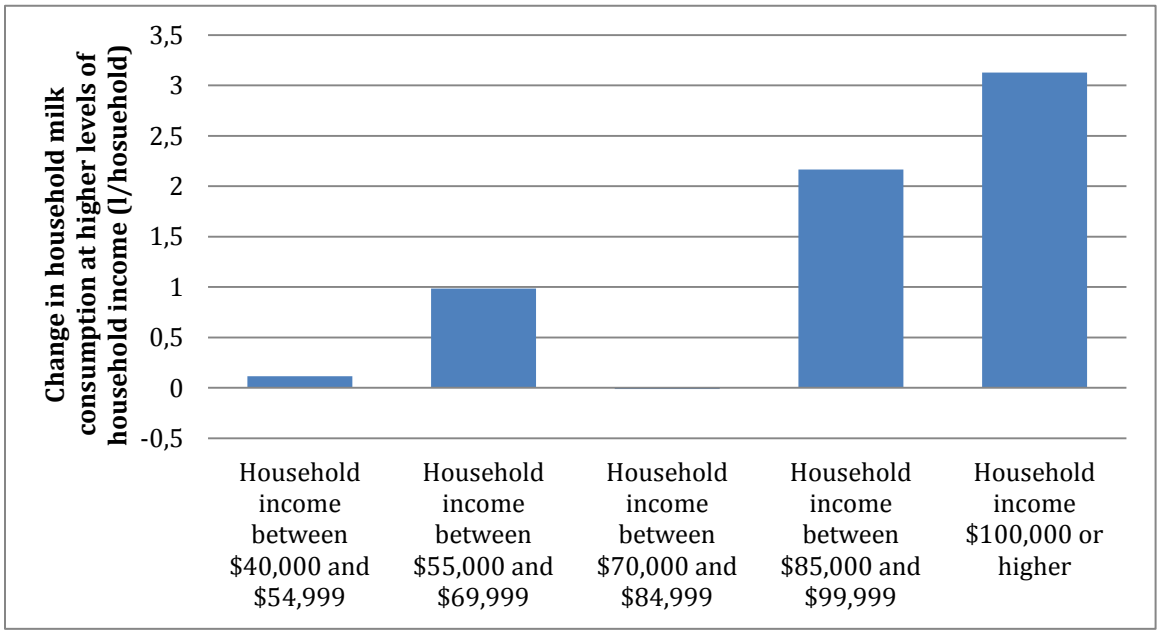
Figure 35: Plot of the coefficients on the children in the home dummy variable coefficients in the national cheese model (the omitted group are households with no children under 18 years of age)



3.4.2. Ontario milk model

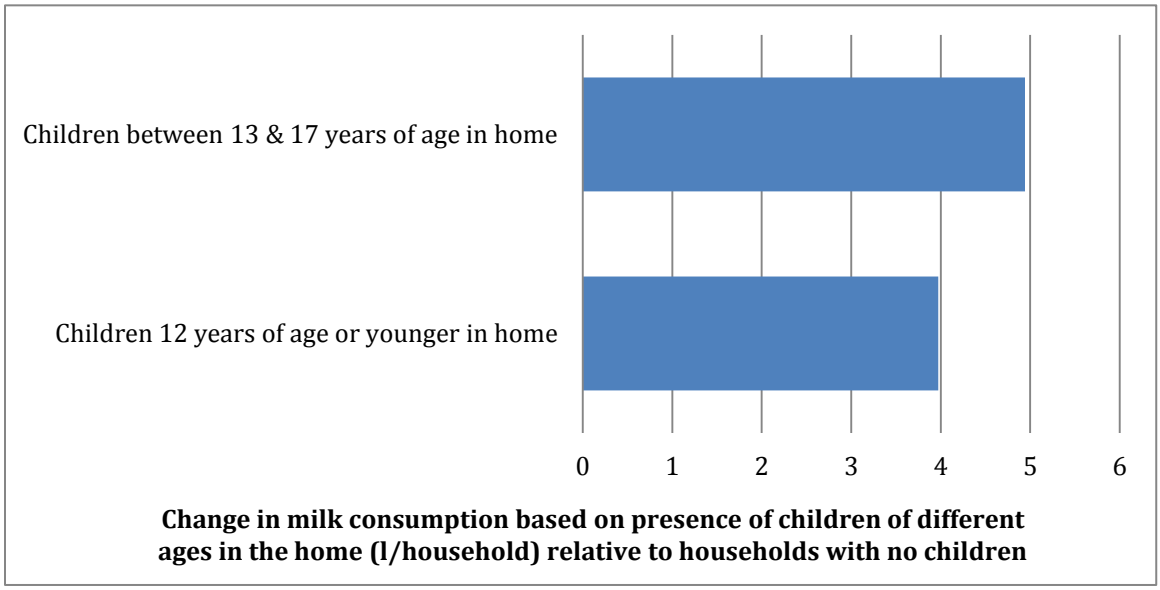
Results for the Ontario milk model are shown in columns 4 and 5 in Table A.7. Households with married couples had higher milk consumption compared to the omitted group of households without married couples. Household size was also significant, with larger households consuming more milk. Households where the head of household was under 35 years of age had lower milk consumption compared to households with a head aged between 35 and 49 years of age. As before, another way to look at this is that households where the head was between 35 and 49 years of age had higher milk consumption than households with younger aged heads. Limited significance of the household income variables was found. Only households where income was higher than $85,000 had significantly higher milk consumption than households with income less than $40,000. These coefficients are plotted in Figure 36. Again, these effects are net of the effect of other variables in the model.

Figure 36: Plot of the household income dummy variable coefficients in the Ontario milk model (the omitted group are households with income under $40,000)



Coefficients on the dummy variables for households with children of different ages were highly significant and positive. This means that relative to the omitted group (households with no children under the age of 18) households with children under 13 years of age consumed significant more milk, as did households with children between 13 and 17 years of age. Both of these effects are highly significant (for reference they are plotted below in figure 37, and are net of the effect of other variables in the model)

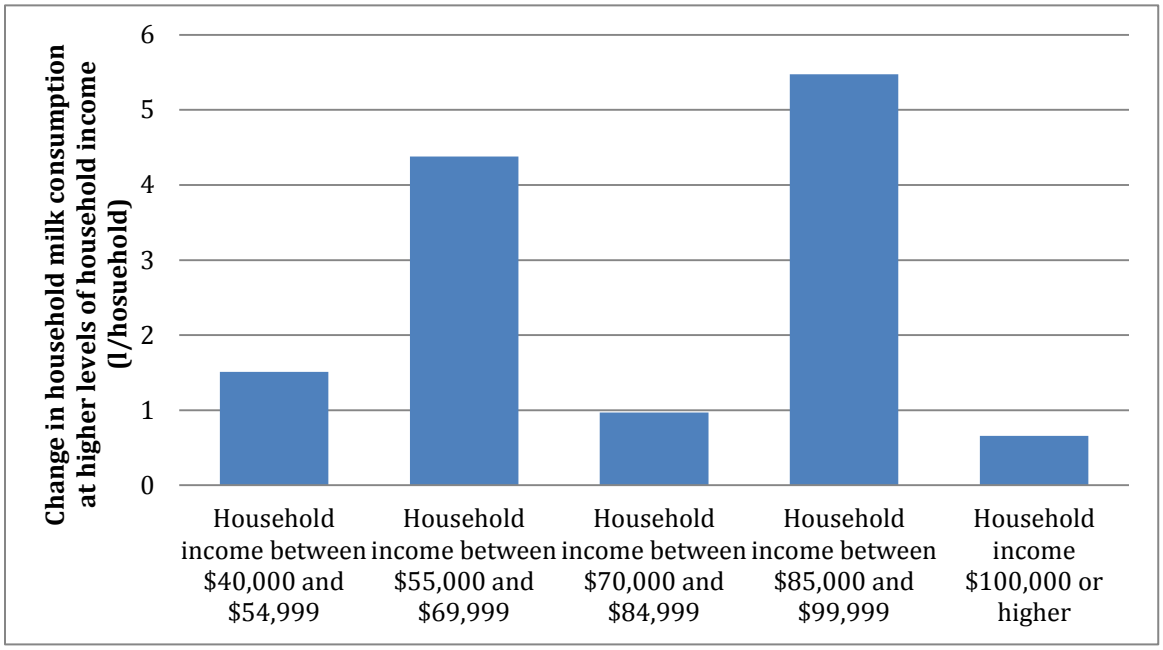
Figure 37: Plot of the coefficients on the children in the home dummy variable coefficients in the Ontario milk model (the omitted group are households with no children under 18 years of age)



3.4.3. Maritime milk model

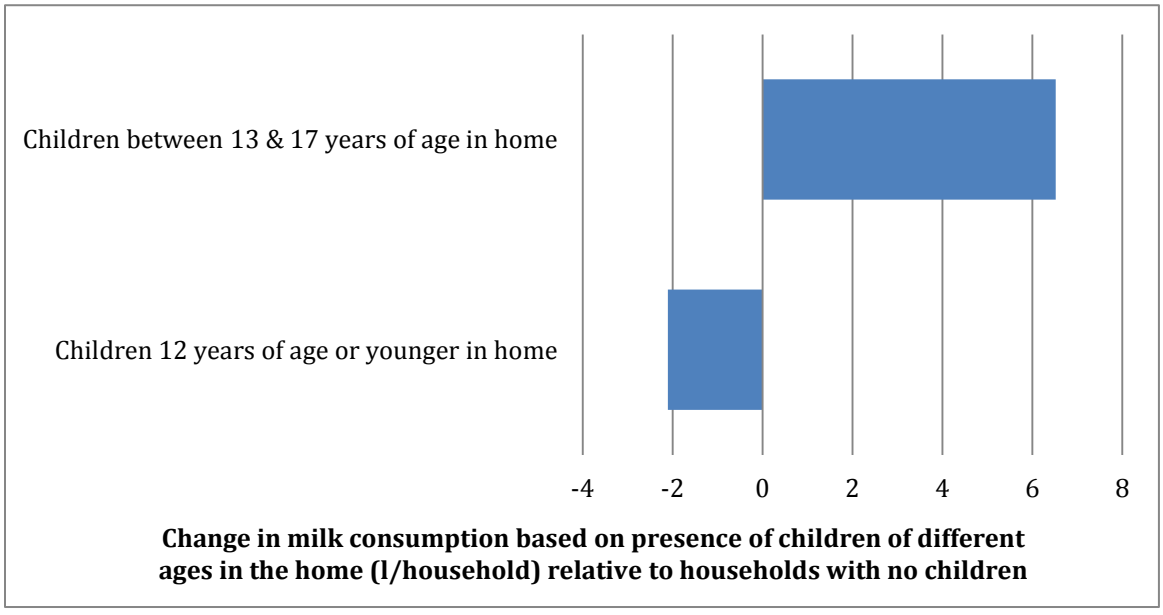
Results for the Maritime milk model are shown in columns 6 and 7 in Table A.7. Non-English speaking households in the Maritimes consumed significantly less milk than English speaking households. Moreover, households with married couples had higher milk consumption compared to the omitted group of households without married couples. Household size was also significant, with larger households consuming more milk. Households where the head of household was under 35 years of age had lower milk consumption compared to households with a head aged between 35 and 49 years of age. As with Ontario, limited significance of the household income variables was found. When significant, the coefficients on the respective household income dummy variables were positive. These results indicate that when compared to households with income under $40,000, increases in income could lead to increased milk consumption (for households in the $55,000 to $69,999 and $85,000 to $99,999 income brackets) or at the very least has no effect (for households in the $40,000 to $55,000 and $70,000 to $85,000 income brackets). These coefficients are plotted in Figure 38. As with the Ontario model above, these effects are net of the effect of other variables in the model.

Figure 38: Plot of the household income dummy variable coefficients in the Maritime milk model (the omitted group are households with income under $40,000)



Coefficients on the dummy variables for households with children of different ages were highly significant. Relative to the omitted group (households with no children under the age of 18), households with children under 13 years of age consumed significant less milk. However, households with children between the ages of 13 and 17 had significantly higher milk consumption during the study period than households with no children. For reference they are plotted below in figure 39, and are net of the effect of other variables in the model.

Figure 39: Plot of the coefficients on the children in the home dummy variable coefficients in the Maritime milk model (the omitted group are households with no children under 18 years of age)



4. SIMULATIONS & RATE OF RETURN CALCULATIONS

In the previous section, the econometric models for fluid milk in Ontario and the Maritimes as well as for cheese categories were presented. Such models allow one to understand the impact of generic promotion and advertising amongst other variables in the fluid milk and cheese markets. Although such information is quite important, what matters most for dairy farmers is the return on their investment. Put differently, is putting more dollars marketing activities a good investment for dairy farmers?

To answer this question, the econometrically estimated demand equations are used to simulate the demand response to variations in nutrition communication, generic advertising and promotion for a certain period of time. From these simulations, an average and marginal rate of return can be computed. The average producer rate of return (APROR) measures the producer return to total investment in generic advertising and promotion, while the marginal producer rate of return (MPROR) measures the producer return to incremental investment in generic advertising and promotion. The APROR is useful in evaluating the overall effectiveness of advertising, while the MPROR is useful in examining the optimal level and allocation of advertising.

The econometric results show that demand for cheese and fluid milk in both regions respond positively to an increase in marketing activities spending. The resulting increase in demand creates a new equilibrium price and quantity which correspond to the point where the new demand equal supply. Given that the Canadian dairy sector is under supply management, which implies that supply is adjusted to the demand for a targeted dairy component price, we are making the assumption that any retail demand increased for dairy components, in the form of milk or cheese, is transferred to dairy farmers.

4.1. Procedures used for simulating rate of returns

4.1.1. Average Producer Rate of Return (APROR)

The APROR is computed using simulations generated by the econometric model. A base simulation is estimated for the period 2007:2 – 2011:4[12] that takes into account all the variables in the econometric model. Then, an econometric simulation that removes DFC's marketing activities is generated[13]. The subtraction of this latter simulation from the base, allows the estimation of the average impact of DFC marketing activities on the consumption of the dairy product of interest. One then needs to translate the change in consumption quantities in net

[12] 2007:2 stands for second quarter of 2007. Given that the econometric model is lagged one period, the first estimation is the second quarter of 2007.

[13] Given the log nature of the econometric model, one cannot use zero for marketing activities. Thus, marketing activities were reduced to 1%. In other words, 99% of the marketing activities were removed.

dollars for dairy farmers. In order to do so, a marginal return to producers is computed for the dairy products of interest. That marginal return is computed taking into account class prices, the mixed of products, yield as well as solid non fat (SNF) and butterfat (BF) impacts on other classes. More specifically, for cheese, a weighted return per major type of cheese is computed for each year taking into account SNF and BF utilization. For cheese, the utilization of milk protein concentrate (MPC) was considered in the marginal return to producers[14]. For fluid milk, a weighted marginal return per major type of milk (skim milk, 1%, 2% and homo) is computed for each year ,the yield used is therefore one.

From that marginal return (for both cheese and fluid milk), an estimated marginal cost (cash cost + interest payments) of producing milk is deducted. The number obtained is then divided by the spending in DFC marketing activities. The APROR is computed using the average of each quarterly change in consumption, divided by DFC's quarterly spending in marketing activities. This allows to smooth potential impact of a spike in spending in a specific quarter. Nevertheless, each APROR was also computed for the whole period to confirm the validity of the calculations.

The APROR indicates how much, in average, a dollar invested during the period 2007 -2011 in a specific DFC's marketing activity yielded. For instance, an annual APROR of 2 indicates that, in average, a dollar invested in a DFC's specific marketing activity any year during the 2007-2011 period yield $2. This measure helps to evaluate the overall effectiveness of advertising.

4.1.2. Marginal Producer Rate of Return (MPROR)

The MPROR is also computed using simulations generated by the econometric model. The same base simulation is estimated for the period 2007:2 – 2011:4 using the full econometric model. Then, an econometric simulation that increases DFC's marketing activities by 1% per quarter is generated. The subtraction of the base from this latter simulation, allows the estimation of the marginal impact of DFC marketing activities on the consumption of the dairy product of interest. As previously, one needs to translate the change in consumption quantities in net dollars for dairy farmers. In order to do so, a price at the farm for the specific dairy product of interest is computed. That price takes into account class prices, the mixe of products, yield as well as solid non fat and butterfat impacts on other classes. The same details mentioned in the APROR section apply for computing the MPROR for cheese and for fluid milk. From that price, an estimated marginal price (cash cost + interest payments) of producing milk is deducted. The number obtained is then divided by the equivalent of a 1% increase in spending for DFC marketing activities. The MPROR is computed using the average of each quarterly change in consumption, divided by an increase of 1% in DFC's average quarterly spending in marketing activities.

[14] The average computed yield used for the period is 7.419. It means that 7.419 liters of milk are needed to produce one kg of cheese.

The MPROR indicates what the monetary return would be if spending in DFC's marketing activities was to be slightly increased (1% per quarter). If the MPROR is less than one, it indicates that a marginal increase would yield less than its cost. If it is more than one, it then indicates that investing more money in this specific marketing activity is a positive investment. For instance, an MPROR of 1.5 indicates that, at the margin, a dollar invested in a DFC's specific marketing activity yield $1.50. In economic optimization, in the absence of a budget constraint, one would invest until the marginal return is equal to one. Thus, an MPROR greater than one implies underinvestment (relative to an optimal) for a specific marketing activity. On the other hand, and MPROR less than one implies overinvestment (relative to an optimal) for a specific marketing activity. MPROR helps to make optimal allocation level of marketing activities between dairy products and marketing vehicles.

Before presenting the rate of return results, one should note that these calculations are dependant of the econometric models. Thus, they are estimates to which an error term is associated, and they should not be treated like absolute numbers but rather like indicators.

4.2. Rate of return results

4.2.1. Results for cheese in Canada (excluding Quebec)

Figure 40 visually assesses the impact of all DFC's marketing activities on the Canadian cheese market. Using the econometric model, and the endpoint estimates (2007 and 2011), we found that between 2007 and 2011, the household cheese market in Canada has grown by 14.5 M kg or 8% (from 182 M kg to 196.5 M kg).[15]

Figure 40 also indicates that in the absence of marketing activities from DFC, the market growth would have been slightly over 1 million kg (or less than 1%) between 2007 and 2011. Therefore, the impact of marketing activities from DFC is 13.3 million kg or 7.3% (196.5 - 183.2). Other potentially important variables are population growth and brand advertising. In an effort to isolate these potentially important variables, simulations were generated with population fixed at its 2007 level in one instance and in the absence of brand advertising in the other instance.[16] Figure 40 shows that the impact of population growth between 2007 and 2011 amounts to roughly 10 M kg (183.2 – 173.9). Similarly, the impact of brand advertizing between 2007 and 2011 at the household level is 10.4 million kg (183.2 – 172.8).

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[15] Figure 40, as well as Figures 43 and 46, use endpoint estimates (2007 and 2011) that are linearly connected for illustrative purpose. These estimates are related, but different than the APROR computation. The APROR computation takes into account all the variable present in the econometric model in order to isolate DFC's marketing activity impact, as opposed to Figures, 40, 43 and 46 that compares endpoints.

[16] Expenses were in fact at 1% given the log structure of the model. One exception is fluid milk in the Maritimes where brand advertising was removed from the model for econometric reasons

Figure 40: Estimated effect of DFC's marketing activities on the market for cheese in Canada (excluding Quebec), measured at the household level for the period 2007-2011

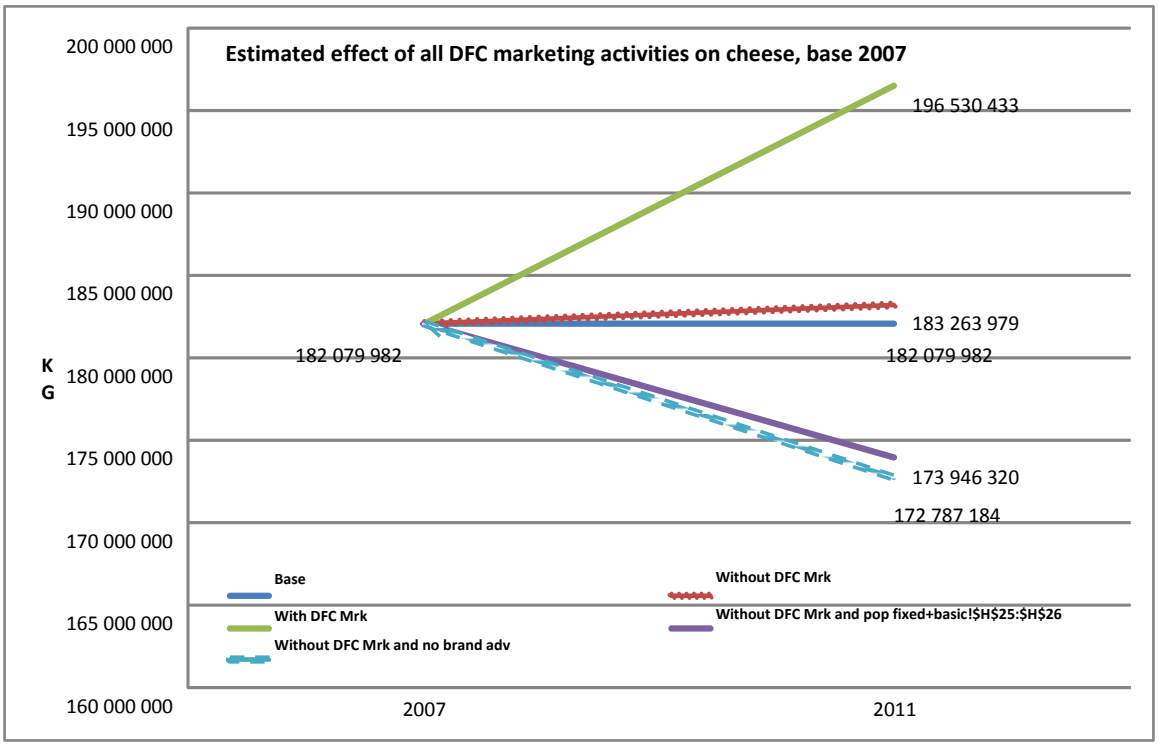
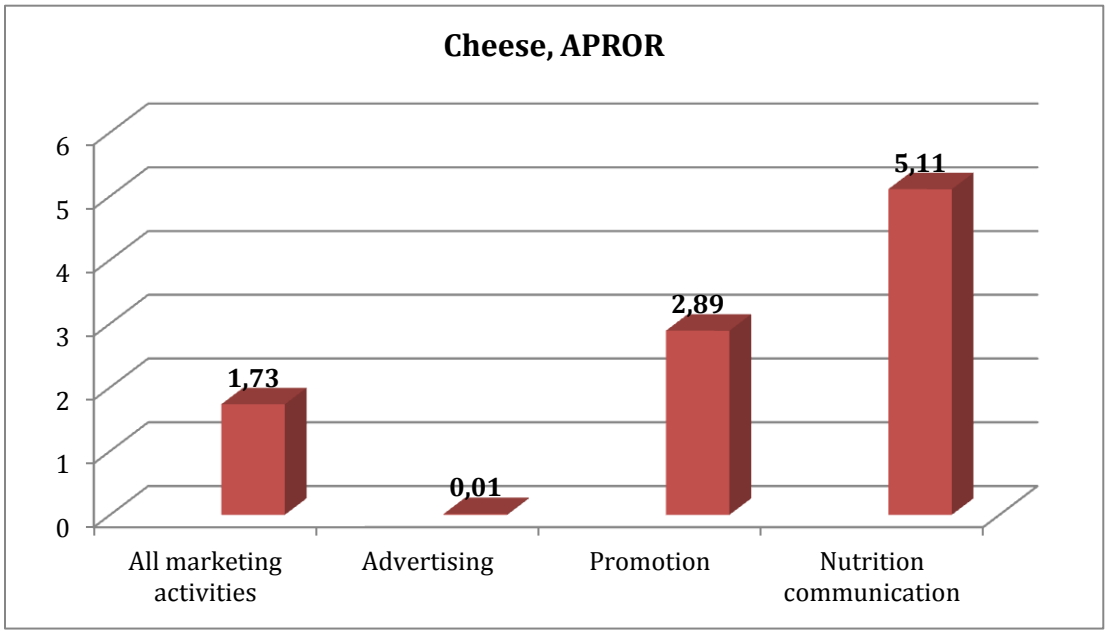


Figure 41: APROR for three marketing activities and their sum, for cheese in Canada (excluding Quebec), measured at the household level for the period 2007-2011

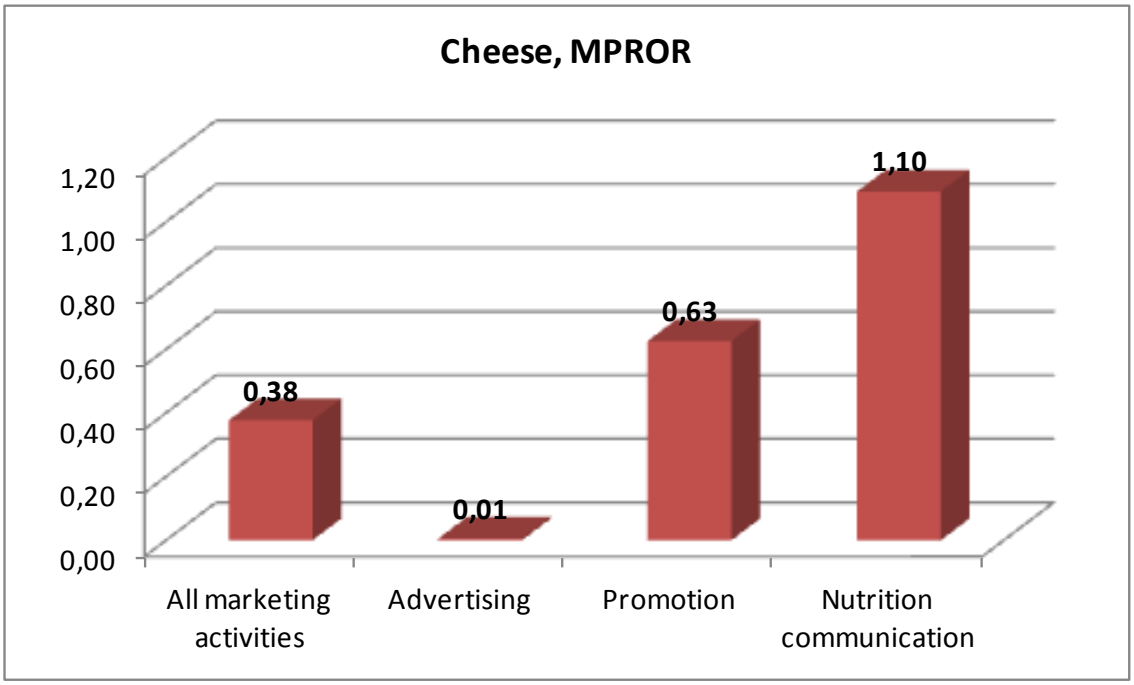


The APROR of 1.73 (Figure 41) indicates that in average, for cheese, a dollar invested in marketing activities (the sum of advertising, promotion and nutrition communication) by DFC during the period 2007-2011 has generated $1.73 when looking at Canadian household

consumption. In other words, farmers have made in average a net gain of $0.73 for every dollar invested in the cheese DFC promotion and nutrition package during that period.

Assuming that in our model marketing dollars have been allocated correctly between the various marketing activities, Figure 41 indicates that in average, a dollar spent in advertising has generated a net loss of $0.99. In other words, during the 2007-2011 period, in average, advertising has not generated sufficient sales to cover its cost. At the opposite, a dollar spent in promotion or nutrition has generated a net gain of $1.89 and $4.11, respectively. Given that the nutrition communication program is relatively modest and that it started during the period of interest, it is not surprising to see a greater impact, in average, for this program.

Figure 42: MPROR for three marketing activities and their sum, for cheese in Canada (excluding Quebec), measured at the household level for the period 2007-2011



The MPROR of 0.38 (Figure 42) indicates that at the margin, for cheese, an extra dollar invested in marketing activities (the sum of advertising, promotion and nutrition communication) by DFC during the period 2007-2011 would have generated $0.38 at the Canadian household consumption level. It seems that farmers would have gained by investing less in the marketing mix of DFC for cheese that was used for the 2007-2011 period.

In other words, assuming that in our model marketing dollar have been allocated correctly between the various marketing activities and assuming that the efficiency of the marketing tools mix is constant; Figure 42 indicates that the aggregate level of spending by DFC for marketing activities might be too high (coefficient inferior to 1). For instance, based on the MPROR at the household level, too much is spent on advertising and promotion. On the other hand, the level of spending on nutrition communication is adequate (coefficient near 1).

If one was to keep the same level of spending, using Figure 41 and Figure 42, marketing budget should be moved from advertising to nutrition communication and to a lesser extent to promotion.

However, one should remember that the impact has been measured only at the household level. It is very likely that DFC's marketing activities also impact consumption of cheese outside the home (restaurants, institutions, etc.). To estimate a spillover effect, the (documented) assumption is made that 20% of the difference between total cheese consumption and household consumption (roughly 1 kg per capita) can be attributed to DFC's marketing activities. The results are presented in Table 4.

Table 4: APROR and MPROR for three marketing activities and their sum, for cheese in Canada (excluding Quebec), measured at the household level with a spillover effect of 20% (1.02 kg), for the period 2007-2011

	APROR	MPROR
Total DFC Mrk activities	1.98	0.45
Advertising	0.02	0.01
Promotion	3.41	0.74
Nutrition communication	5.82	1.29

Results at table 4 show that the spillover effect increases all the APROR and MPROR, but do not change our previous interpretations.

4.2.2. Results for fluid milk in Ontario

From the econometric simulations, Figure 43 shows that the household market for fluid milk in Ontario has declined by 28 M liters (856.7 – 828.8) or 3.2% between 2007 and 2011. However, Figure 43 indicates that the decline would have been of 166 M liters (856.7 – 690.7) or 19% in the absence of DFC's marketing activities. Therefore, the impact of marketing activities from DFC is 138 M liters (828.8 – 690.7) or 16%. As for cheese, other potentially important variables are population growth and brand advertising. In an effort to isolate these potentially important variables, simulations were generated with population fixed at its 2007 level in one instance and in the absence of brand advertising in the other instance. Figure 43 shows that the impact of population growth from 2007 to 2011 amounts to roughly 31 M liters (690.7 – 659.5). Similarly, the impact of brand advertizing between 2007 and 2011 at the household level is 117 million liters (690.7 – 573.5).

Figure 43: Estimated effect of DFC's marketing activities on the market for fluid milk in Ontario, measured at the household level for the period 2007-2011

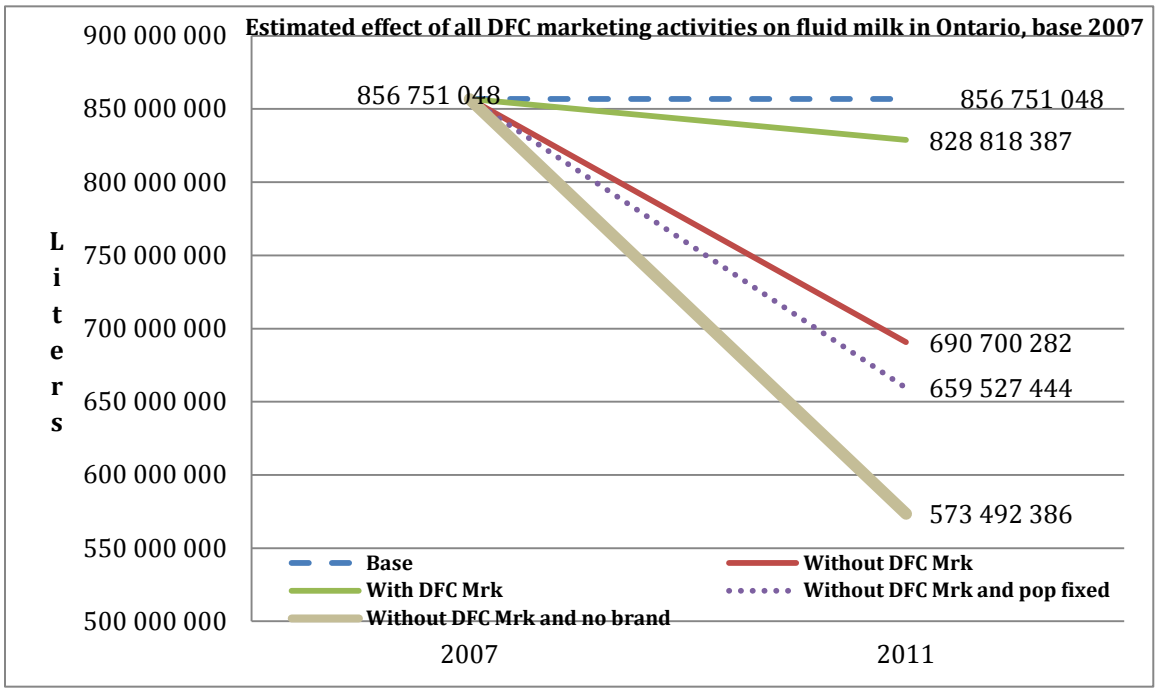
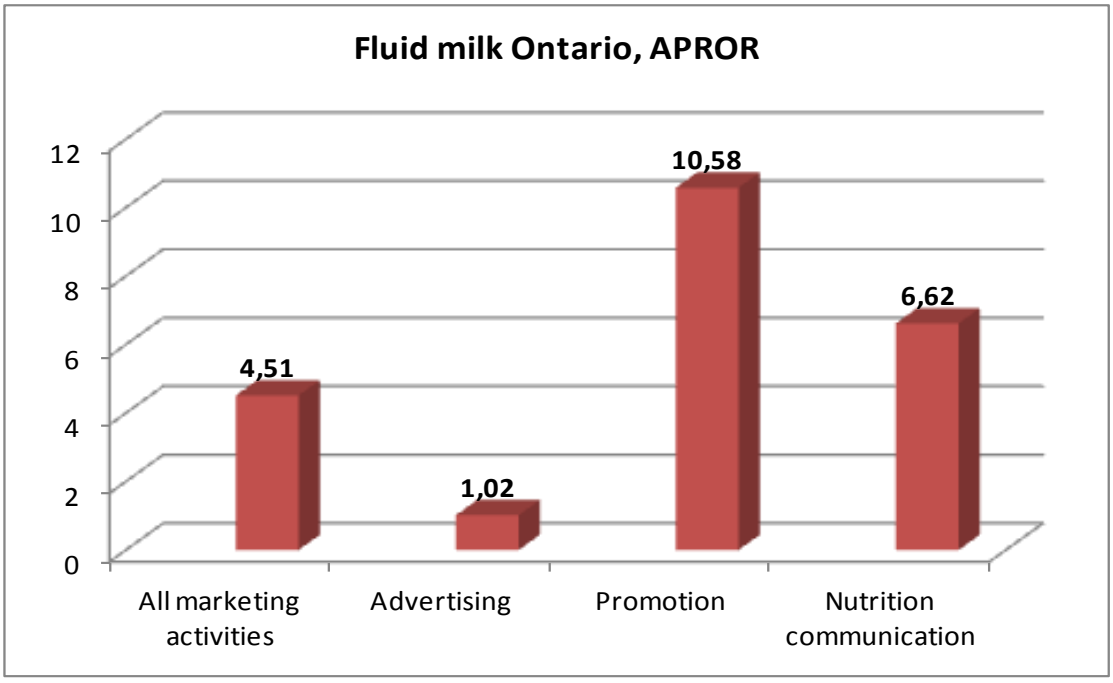


Figure 44: APROR for three marketing activities and their sum for fluid milk in Ontario measured at the household level for the period 2007-2011

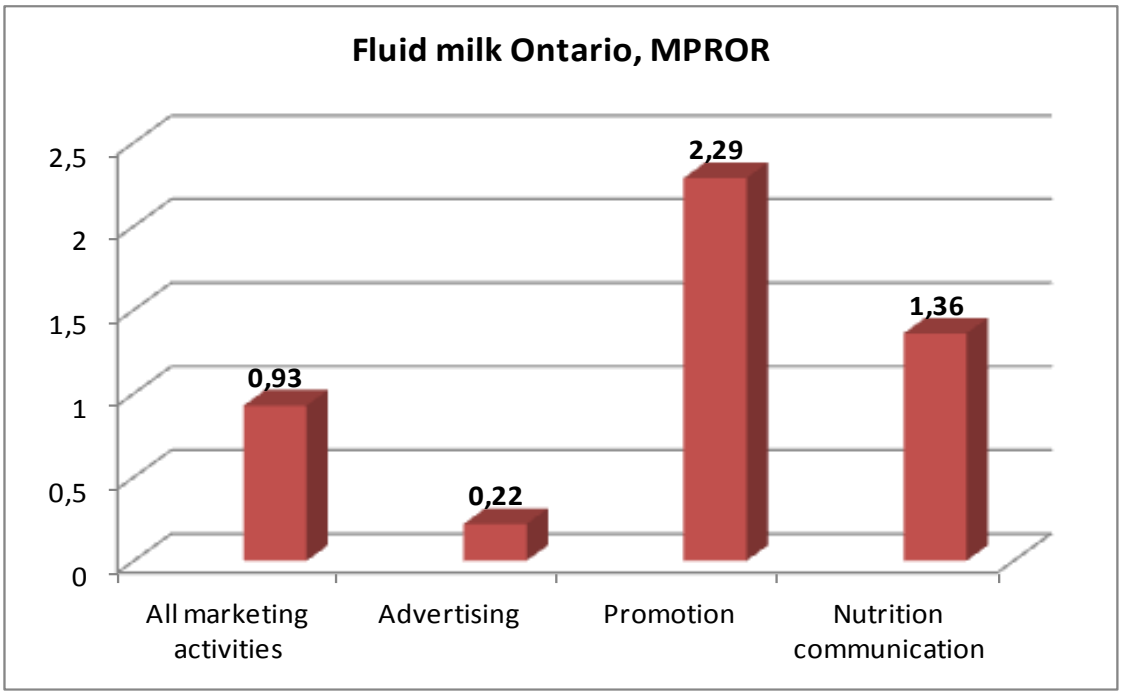


The APROR of 4.51 (Figure 44) indicates that in average, for fluid milk in Ontario, a dollar invested in marketing activities (the sum of advertising. promotion and nutrition communication) by DFC during the period 2007-2011 has generated $4.51 at the Canadian

household consumption level. In other words, farmers have made a net gain of $3.51 for every dollar invested.

Assuming that in our model marketing dollars have been allocated correctly between the various marketing activities, Figure 45 indicates that in average, a dollar spent in advertising has generated a slight gain of $0.02 while a dollar spent in promotion or nutrition has generated a net gain of $9.58 and $5.62, respectively.

Figure 45: MPROR for three marketing activities and their sum, for fluid milk in Ontario, measured at the household level for the period 2007-2011



The MPROR of 0.93 (Figure 45) indicates that at the margin, for fluid milk in Ontario, an extra dollar invested in marketing activities (the sum of advertising. promotion and nutrition) by DFC during the period 2007-2011 would have generated $0.93 at the Canadian household level . Thus, given that the ratio is near 1 and the expected error term, the level of investment seems appropriate. In other words, farmers would not have gain by investing more in the 2007-2011 marketing package of DFC for fluid milk in Ontario, but would have lost by investing less.

Assuming that in our model marketing dollars have been allocated correctly between the various marketing activities and assuming that the efficiency of the marketing tools mix is constant; Figure 45 indicates that the aggregate level of spending by DFC for marketing activities is appropriate. However, better results could likely be achieved by reallocating the aggregate budget between marketing activities. For instance, based on the MPROR at the household level, too much is spent on advertising (ratio < 1) and not enough on nutrition communication and promotion (ratio > 1).

As for cheese, the impact has been measured only at the household level. To take into account the fact that DFC's marketing activities also impact consumption of fluid milk in Ontario outside the home (restaurants. institutions. etc.). A spillover effect is estimated using the (documented) assumption that 95% of the difference between fluid milk consumption and household consumption in Ontario (roughly 22 liter per capita) can be attributed to DFC's marketing activities. The results are presented in Table 5.

Table 5: APROR and MPROR for three marketing activities and their sum, for fluid milk in Ontario, measured at the household level with a spillover effect of 95% (21.9 l) for the period 2007-2011

	APROR	MPROR
Total DFC mrk activities	6.19	1.27
Advertizing	1.39	0.30
Promotion	14.50	3.14
Nutrition communication	9.07	1.86

Results at Table 5 show that the spillover effect increases all the APROR and MPROR. It confirms that the aggregate level of spending is adequate for fluid milk in Ontario, and that it would even be beneficial to increase it at the margin. Otherwise, the inclusion of the spillover effect does not change our previous interpretations.

4.2.3. Results for fluid milk in the Maritimes

From the econometric simulations, Figure 46 shows that the household market for fluid milk in the Maritimes has declined by 5.4 M liters (106.4 – 101) or 5% between 2007 and 2011. However, Figure 46 indicates that the decline would have been of 35.8 M liters (106.4 – 70.6) or 34% in the absence of DFC's marketing activities. Therefore, the impact of marketing activities from DFC is 30.4 M liters (101 – 70.6) or 29%. As previously, other potentially important variables are population growth and brand advertising. In an effort to isolate these potentially important variables, simulations were generated with population fixed at its 2007 level in one instance and in the absence of brand advertising in the other instance. Figure 46 shows that the impact of population growth from 2007 to 2011 amounts to roughly 1.1 M liters (70.1 – 69.4). Similarly, the impact of brand advertizing between 2007 and 2011 at the household level is 10.1 million liters (70.1 – 60.4).

Figure 46: Estimated effect of DFC's marketing activities on the market for fluid milk in the Maritimes, measured at the household level for the period 2007-2011

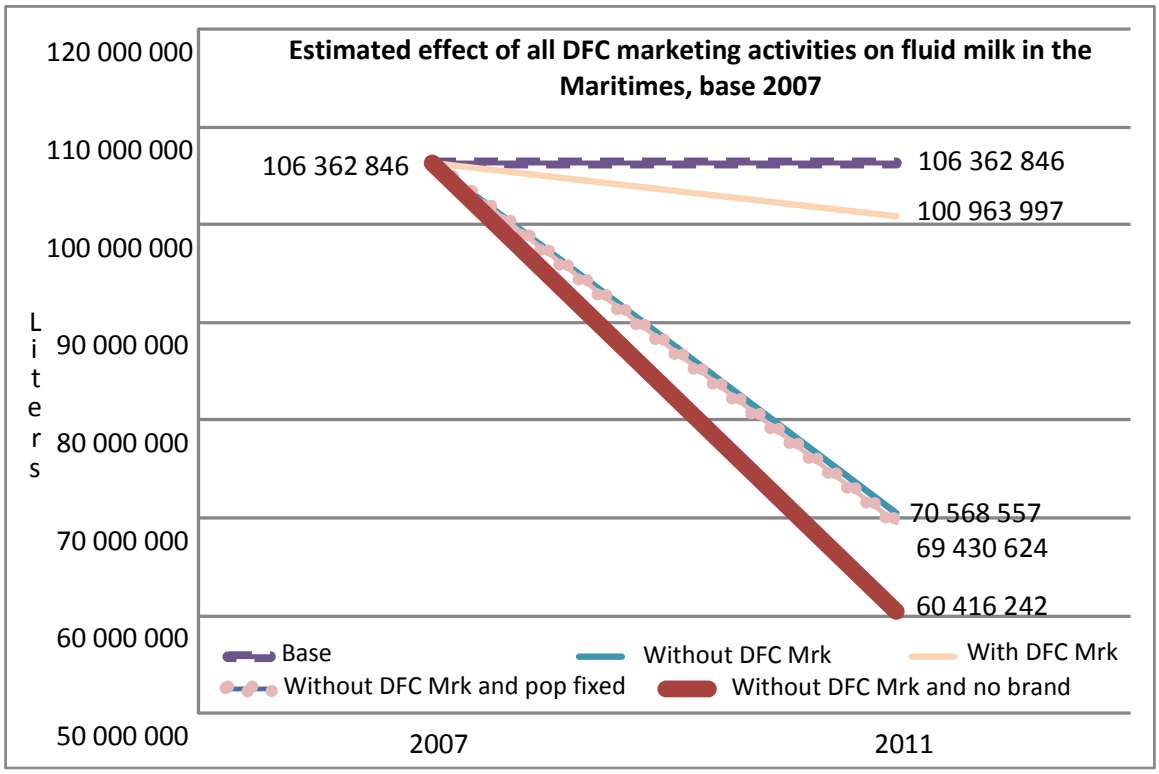
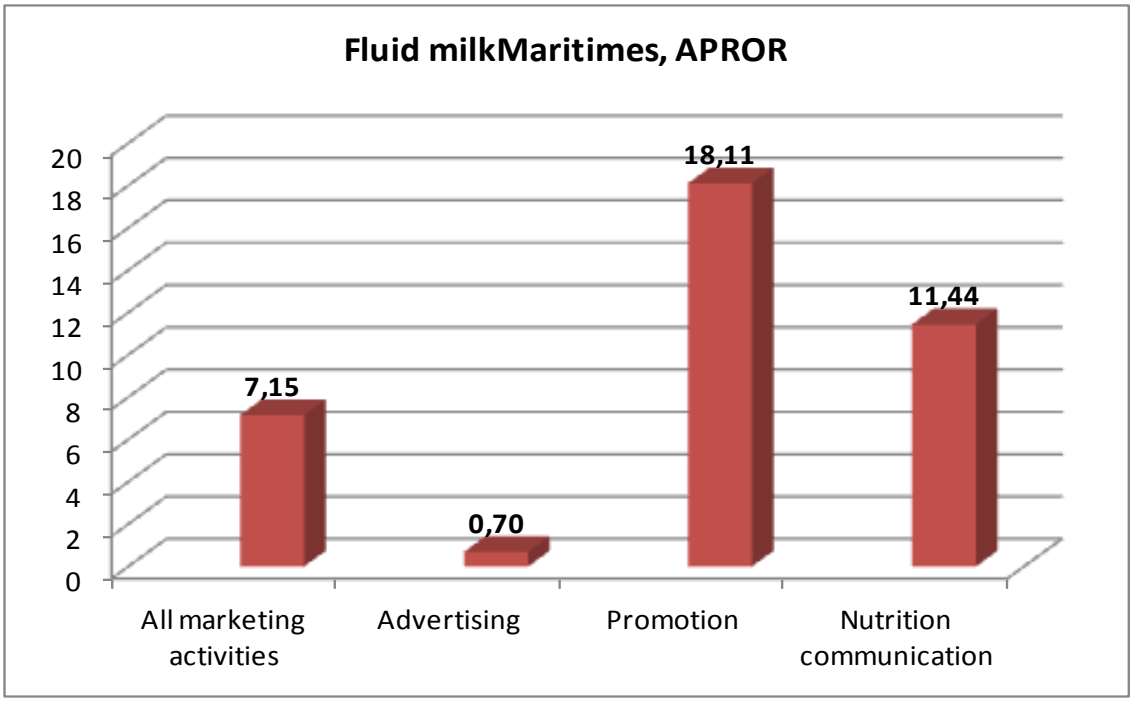


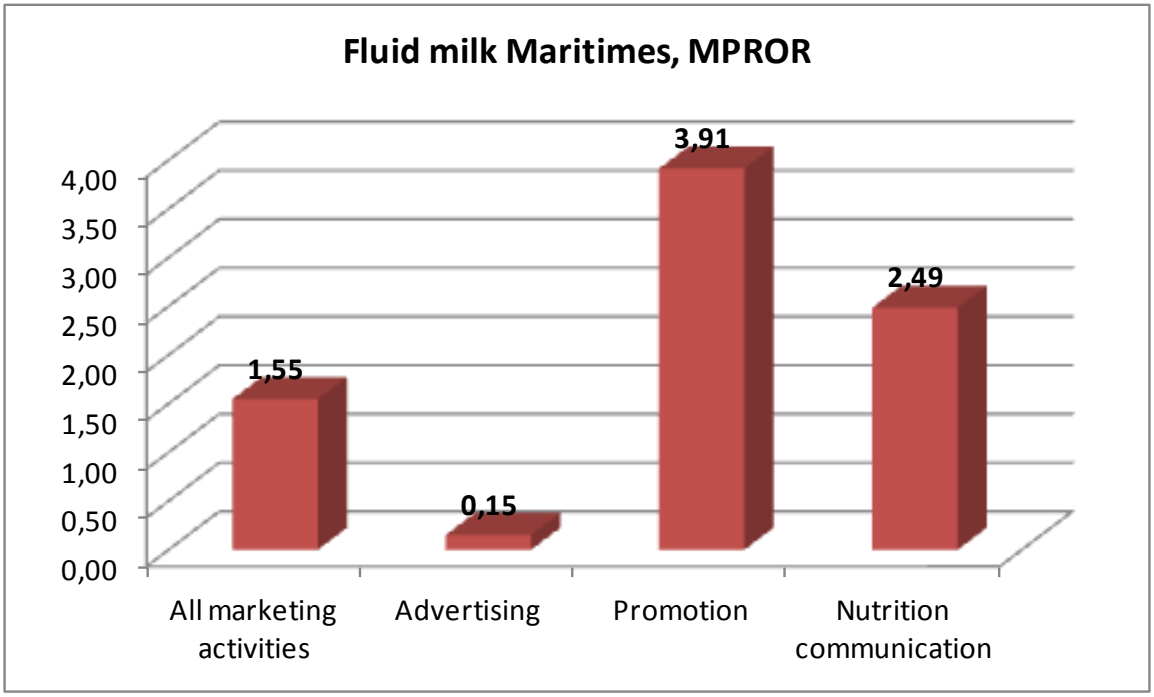
Figure 47: APROR for three marketing activities and their sum for fluid milk in the Maritimes, measured at the household level for the period 2007-2011



The APROR of 7.15 (Figure 47) indicates that in average, for fluid milk in the Maritimes, a dollar invested in marketing activities (the sum of advertising. promotion and nutrition) by DFC during the period 2007-2011 has generated $7.15 at the Canadian household level. In other words, over that period and in average, farmers have made a net gain of $6.15 for every dollar invested.

Assuming that in our model marketing dollars have been allocated correctly between the various marketing activities, Figure 47 indicates that in average, a dollar spent in advertising has generated a net loss of $0.30, while a dollar spent in promotion or nutrition has generated a net gain of $17.11 and $10.44, respectively. Thus, on the basis of APROR, it appears that although in aggregate DFC's marketing activities on fluid milk in the Maritimes have been beneficial to dairy farmers, not all marketing activities had the same impact. For instance, promotion and nutrition communication had a much greater impact. The analysis of the MPROR will allow to better evaluate the allocation between DFC's marketing activities.

Figure 48: MPROR for three marketing activities and their sum for fluid milk in the Maritimes, measured at the household level for the period 2007-2011



The MPROR of 1.55 (Figure 48) indicates that at the margin, for fluid milk in the Maritimes, an extra dollar invested in marketing activities (the sum of advertising. promotion and nutrition communication) by DFC during the period 2007-2011 would have generated $1.55 when looking at household consumption. Thus, the level of investment should be increased at the margin. In other words, farmers would have gained by investing more in the 2007-2011 marketing package of DFC for fluid milk in the Maritimes.

More specifically, assuming that in our model marketing dollars have been allocated correctly between the various marketing activities, greater gain would have resulted from less spending in advertising (ratio less than 1) and greater spending in promotion and nutrition, since their ratios are 3.91 and 2.49 respectively (greater than 1).

As for cheese and fluid milk in Ontario, the impact has been measured only at the household level. To take into account the fact that DFC's marketing activities also impact consumption of fluid milk in the Maritimes outside the home (restaurants. institutions. etc.). This spillover effect is estimated using the (documented) assumption that 95% of the difference between fluid milk consumption and household consumption in the Maritimes (roughly 22 liter per capita) can be attributed to DFC's marketing activities. The results are presented in Table 6.

Table 6: APROR and MPROR for three marketing activities and their sum, for fluid milk in the Maritimes, measured at the household level with a spillover effect of 95% (22.3 l) for the period 2007-2011

	APROR	MPROR
Total DFC mrk activities	9.94	2.15
Advertising	0.97	0.21
Promotion	25.17	5.44
Nutrition communication	15.91	3.46

Results at Table 6 show that the spillover effect increases all the APROR and MPROR. It confirms that the aggregate level of spending for fluid milk in the Maritimes should be increased at the margin, and a reallocation of budget from advertising to promotion and nutrition communication should be made. The inclusion of the spillover effect does not change our previous interpretations.

5. CONCLUSION

In average, for the period 2007-2011, dairy farmers in Canada have globally received a good return for their investments in marketing activities. For cheese, a dollar spent in marketing activities has generated a net gain of $0.73, while it has generated $3.51 and $6.15 for fluid milk in Ontario and the Maritimes, respectively. How can one explain these positive results when between 2007 and 2011 our estimates show that fluid milk consumption has declined by 3.2% and 5% in Ontario and the Maritimes, respectively? This is explained by the significant impact of DFC's marketing activities in maintaining the level of consumption. For instance, between 2007

and 2011, our estimates indicate that in-home consumption would have declined by another 16% in Ontario and another 29% in the Maritimes in the absence of DFC's marketing activities.

The marginal analysis can be used to look more closely at the allocation level of DFC's dollars in marketing activities between products (cheese, fluid milk in Ontario and the Maritimes) and marketing tools (advertising, promotion and nutrition communication). It appears that the global level of spending is too high for cheese, almost sufficient for fluid milk in Ontario and should be increased for fluid milk in the Maritimes. Thus, moving marketing activities budget from cheese to fluid milk in the Maritimes would result in a gain. Moreover, gain can also be made for each product by reallocating budget amongst marketing activities. For instance, for the three products, the MPROR level of spending indicates benefits in reducing the level of spending on advertising.

More specifically, for cheese, the level of advertising should be reduced and to a lesser extent the level of promotion. The level of spending on nutrition communication for cheese seems appropriate. For fluid milk in Ontario, when taking into account the spillover effect, the global level of marketing activities should be increased. However, less money should be spent on advertising while the promotion budget should be increased, and to a lesser extent the nutrition communication budget. Fluid milk in the Maritimes would benefit the most from a marginal increase in marketing activities. As in Ontario, the advertising budget should be reduced, while significant gain would be generated by an increase in promotion budget, and to a lesser extent in nutrition communication.

6. REFERENCES

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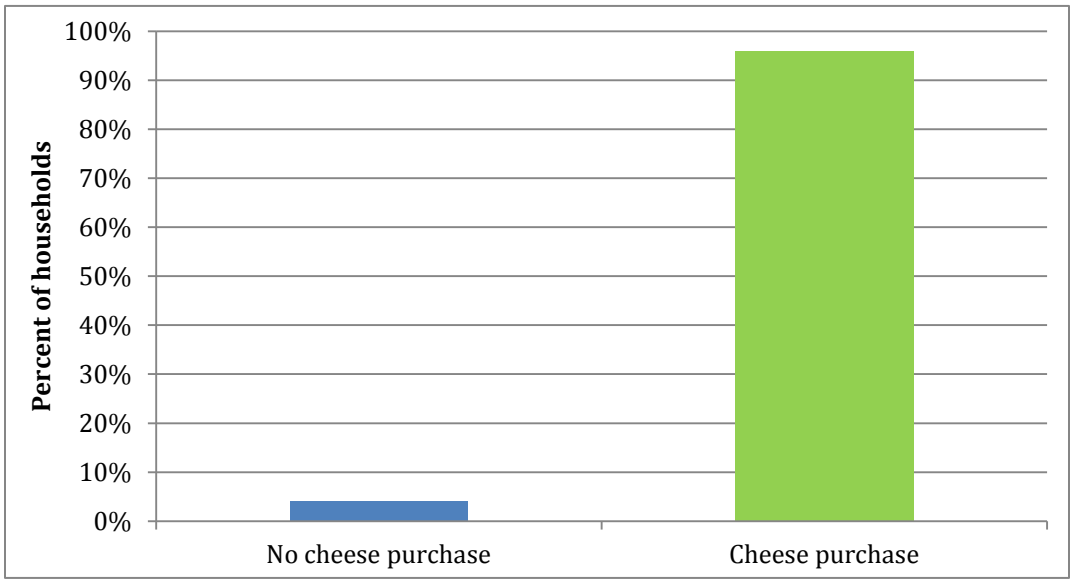
7. APPENDIX

7.1. Household description between buyers and non buyers of specific dairy products

7.1.1. Cheese

It is important to understand differences in the characteristics of households who purchase cheese and those who do not. As shown in Figure A1, 96 percent of the sample (n=145,404) report buying cheese at some point in the 2007-2011 period, while four percent do not report the purchase of cheese. These differences are related to household composition, household income, household size, presence of children of differing ages in the home, and the household's lifestage. In what follows, the data are broken down according to whether the household reports consumption of specific dairy products or not.

Figure A1: Percent of households reporting either no cheese purchase or cheese purchase, 2007-2011



This breakdown focuses on the characteristics of non-consuming households, and consuming households, as separate sub-samples. This allows us to explore whether the pattern of consumption across a particular characteristic, such as household composition, is different for consuming households versus non-consuming households. This means, for instance, that the percent of non-consuming households that report having a married couple will be compared to the percent of consuming households that also report being married. These percents are

relative to whether the household is a consumer or non-consumer of the respective product. Consequently, amongst the non-consuming category, some percentages may seem large; but remember, that this is a large percent of a small number (i.e. the non-consuming households). This is an important point that the reader should bear in mind through the descriptive discussion of the cheese data (where non-consuming households account for a small share of the sample), as well as the milk data for Ontario and the Maritimes (where non-consuming households also account for a small share of the sample).

The majority of households that report buying cheese includes a married couple, followed by households with a single female living alone and a single male living alone (see Figure A2). Amongst households that do not report the purchase of cheese, the lion's share is for households with a married couple, followed by females living alone and males living alone. Interestingly, the frequency with which people who live alone report purchasing of cheese is markedly lower than the same frequency amongst non purchasers of cheese. People who live alone are less like to purchase cheese.

Figure A2: Percent of non-cheese purchasing and cheese purchasing households, by household composition

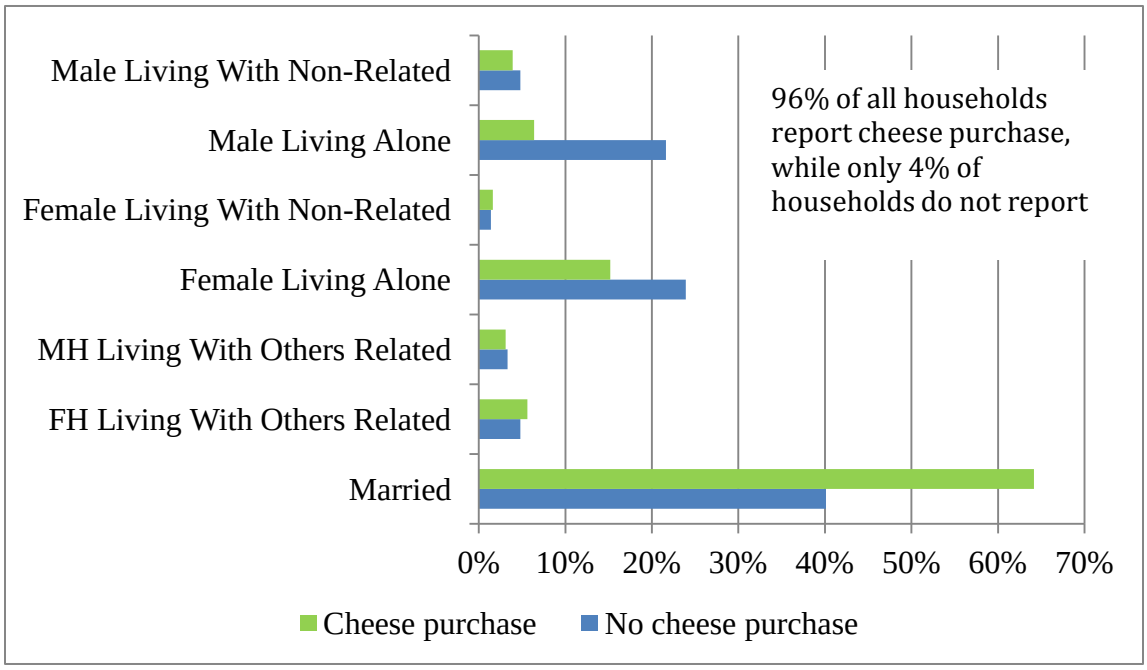


Figure A3 shows that lower income households are more likely to purchase cheese than higher income households, and that the frequency with which cheese purchase is reported falls as household income rises. This could be misleading since only percentages are reported here (as opposed to value).More importantly, Figure A3 indicates that among households who do not purchase cheese, the majority have household income below $40,000 per year.

FigureA3: Percent of non-cheese purchasing and cheese purchasing households, by household income

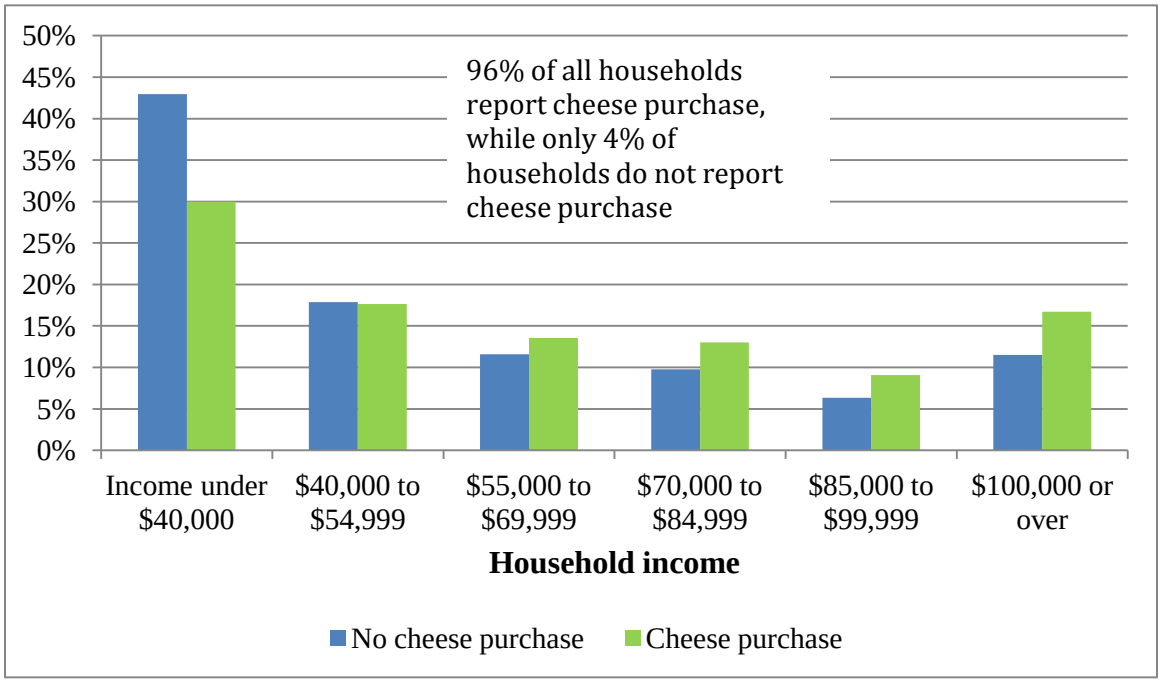


Figure A4 shows the breakdown of household cheese purchase behavior versus household size. There is an inverse relationship between the percent of households reporting non-purchase of cheese and household size (i.e. small households have a high likelihood of not purchasing cheese). In contrast, the percent of households reporting the purchase of cheese rises from a single person household to a two person household and then falls as household size increases.

Figure A5 is perhaps one of the most enlightening figures in that it shows the breakdown of purchasing and non-purchasing households across categories reflecting the presence of children of varying ages in the home. The presence of children increases the likelihood of reporting cheese purchase for the home. Moreover, the proportion of households reporting cheese purchase is about twice as high as those households who do not report cheese purchase when there are children in their teen years (13 to 17 years of age) in the home.

Figure A4: Percent of non-cheese purchasing and cheese purchasing households, by household size

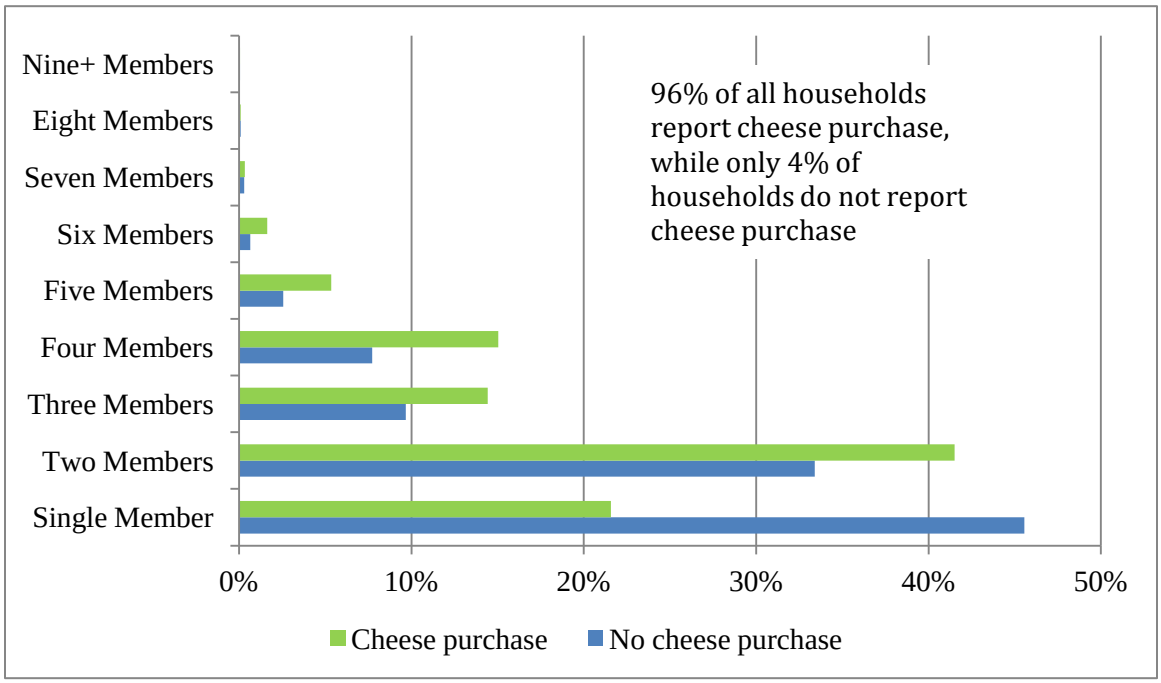
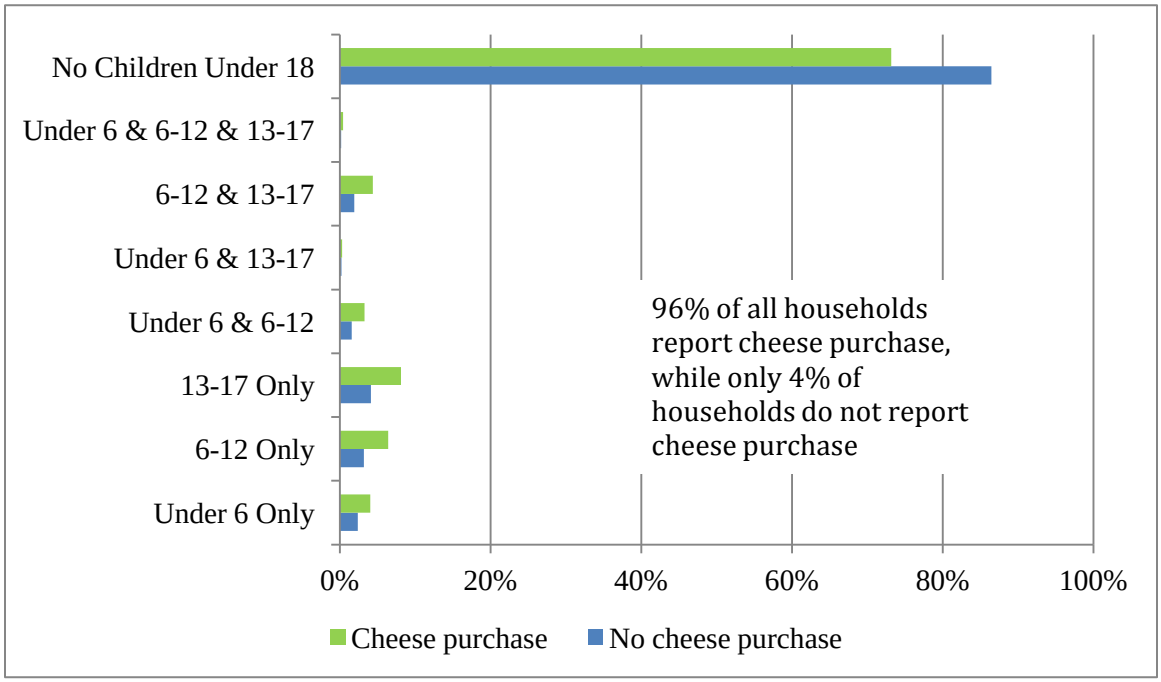
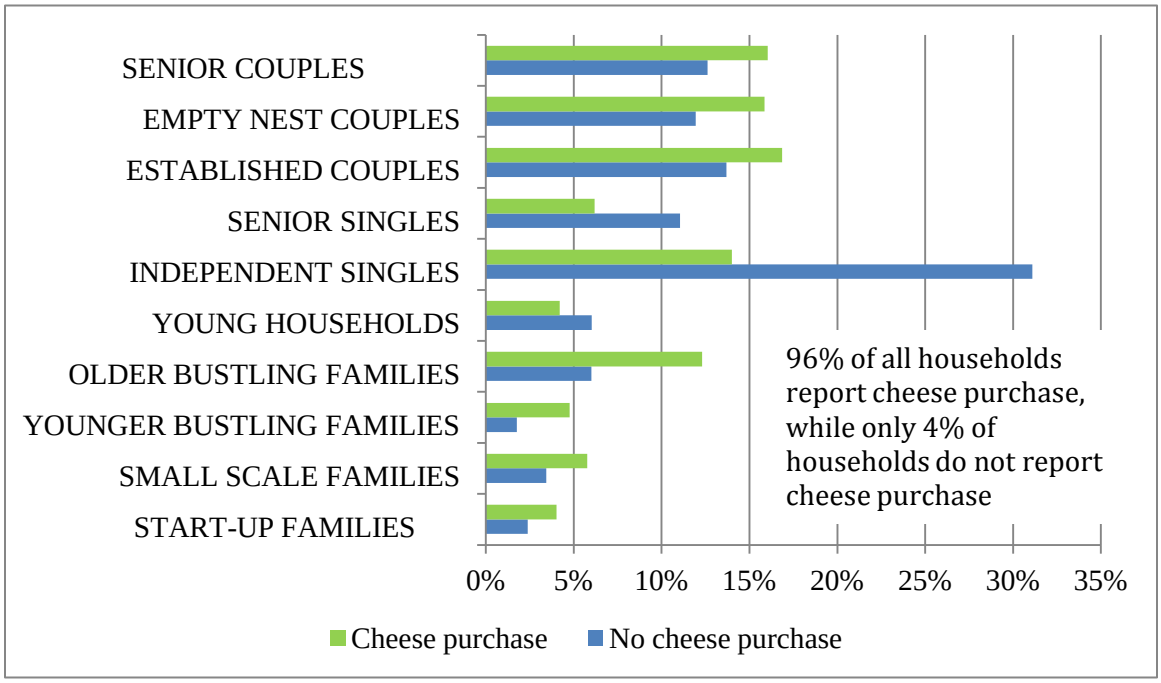


Figure A5: Percent of non-cheese purchasing and cheese purchasing households, by presence of children in the home



A.C. Nielsen provides (but only for the years 2008 to 2011) a life-stage variable that captures the life cycle position of the home. This variable captures many of the demographic variables included in the analysis that follows. Figure A6 shows the breakdown of households (based on their reported cheese purchase behaviour) across the various categories in Nielson's life-stage measure. Two points standout. First, households with single people or younger households account for a large share of households that do not purchase cheese. Second, all other households have a higher frequency of reporting the purchase of cheese than non-purchase.

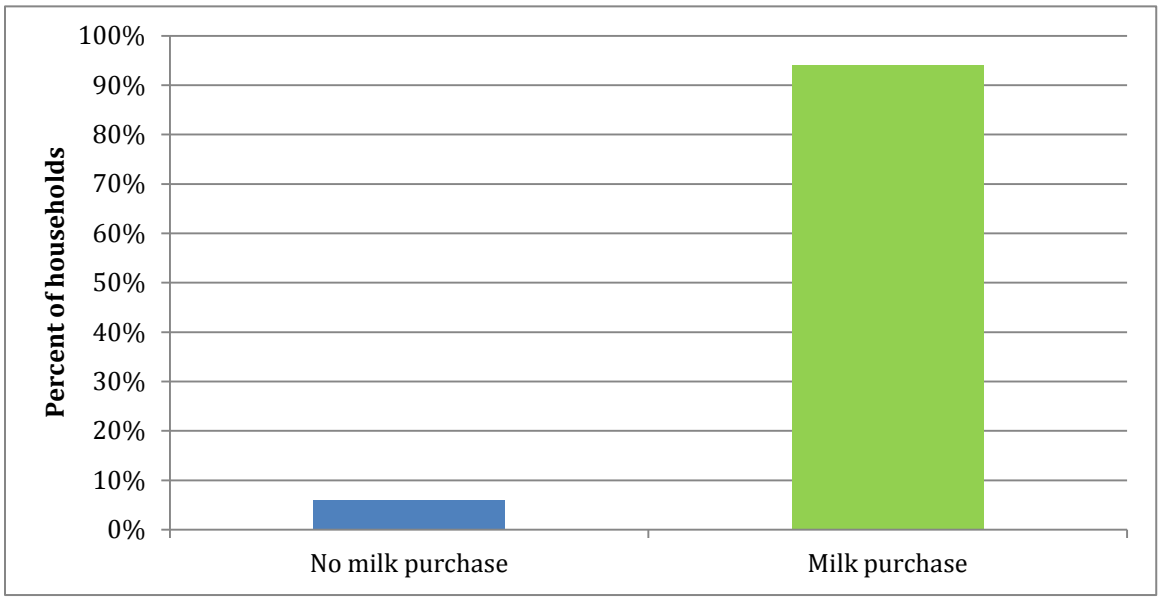
Figure A6: Percent of non-cheese purchasing and cheese purchasing households, by life-stage



7.1.2. Fluid Milk in Ontario

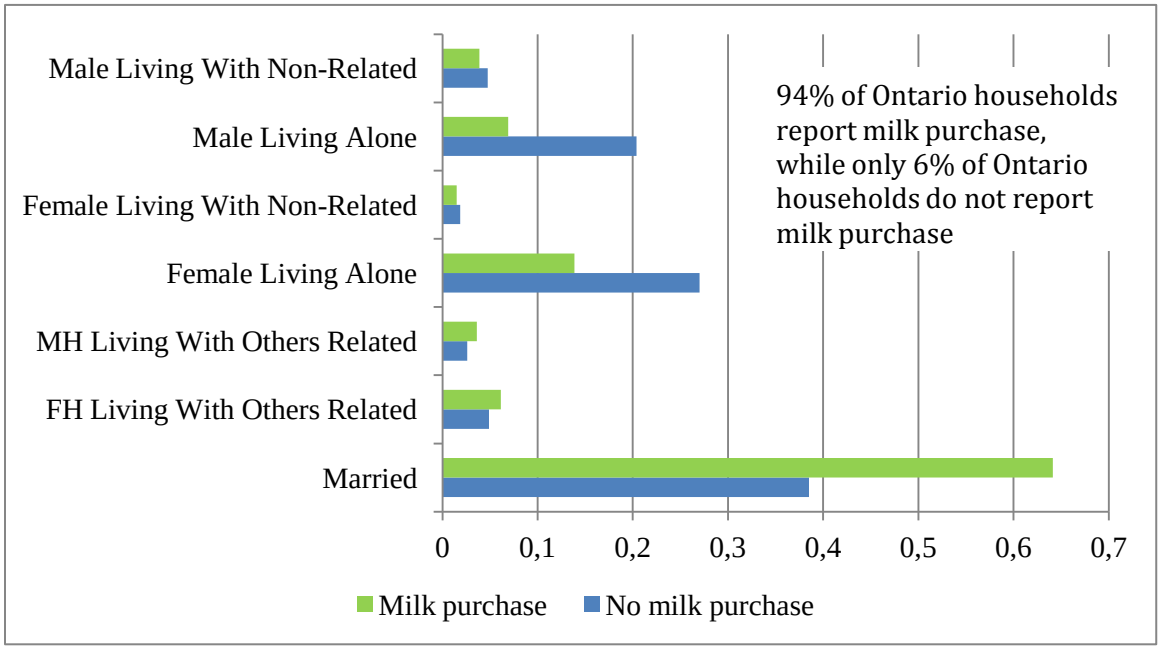
As with cheese, it is important to understand differences in household characteristics across households who purchase milk and those who do not. As shown in Figure A7, that 94 percent of the households in the Ontario sample (n=63,770) report purchasing milk, while only six percent report not purchasing milk.

Figure A7: Percent of Ontario households reporting either no milk purchase or milk purchase, 2007-2011



Regarding household composition, Figure A8 shows plots of the percent of Ontario households (based on their milk purchasing behavior) against Homescan's household composition characteristics. As with cheese, the majority of purchasing and non-purchasing households report being married. Amongst non-purchasers, however, about 40% report being married and about 20 and 27% report being a single male or female, respectively.

Figure A8: Percent of non-milk purchasing and milk purchasing Ontario households, by household composition



Across household income, Figure A9 shows the proportion of households reporting the purchase or non-purchase of milk versus household income ranges. As with cheese, amongst purchasers and non-purchasers of milk, the highest frequency occurs for households with income below $40,000. Note too that the percent of household reporting the purchase of milk generally falls at higher income categories (granted the percent of purchasing households rises for those with income of $100,000, but this reflects this last category's broader range of household income compared to the narrower ranged in the first four household income categories). Nonetheless, it is also evident that the frequency of milk purchase is higher than the frequency of not purchasing milk for households with income higher than $55,000.

Figure A10 shows the breakdown of households according to milk purchase versus household size. Amongst non-purchasing households, more of them come from smaller homes. In contrast, the percent of households reporting the purchase of milk rises from a single person household to a two person household and then falls as household size increases.

Figure A9: Percent of non-milk purchasing and milk purchasing Ontario households, by household income

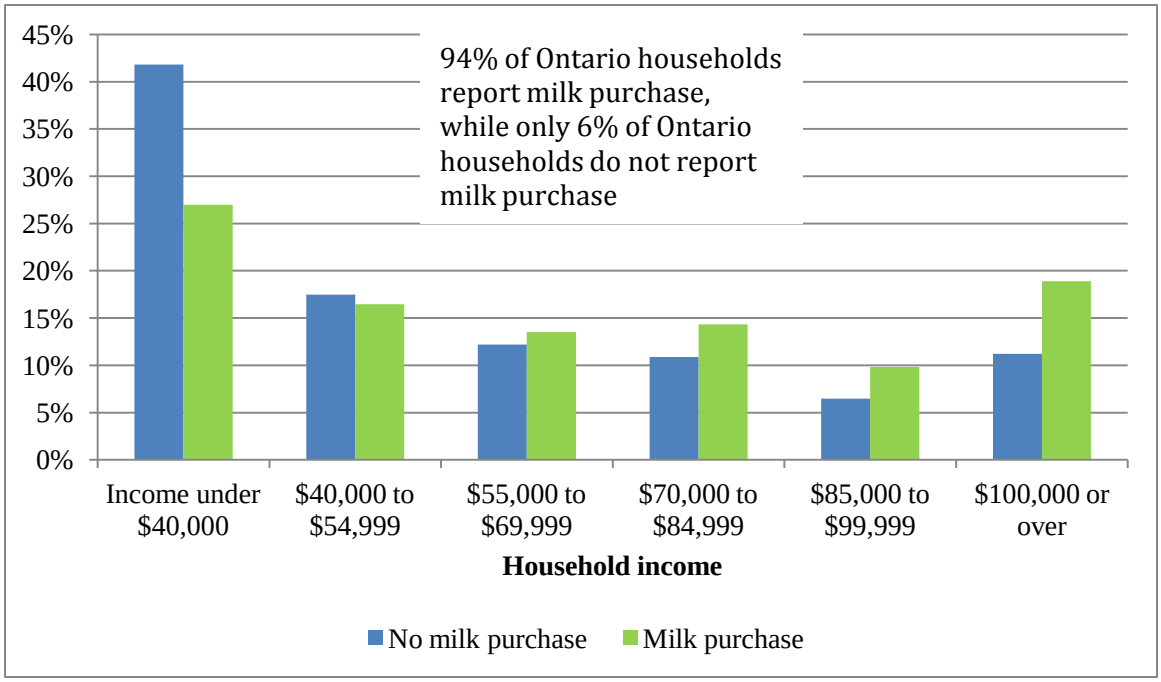


Figure A10: Percent of non-milk purchasing and milk purchasing Ontario households, by household size

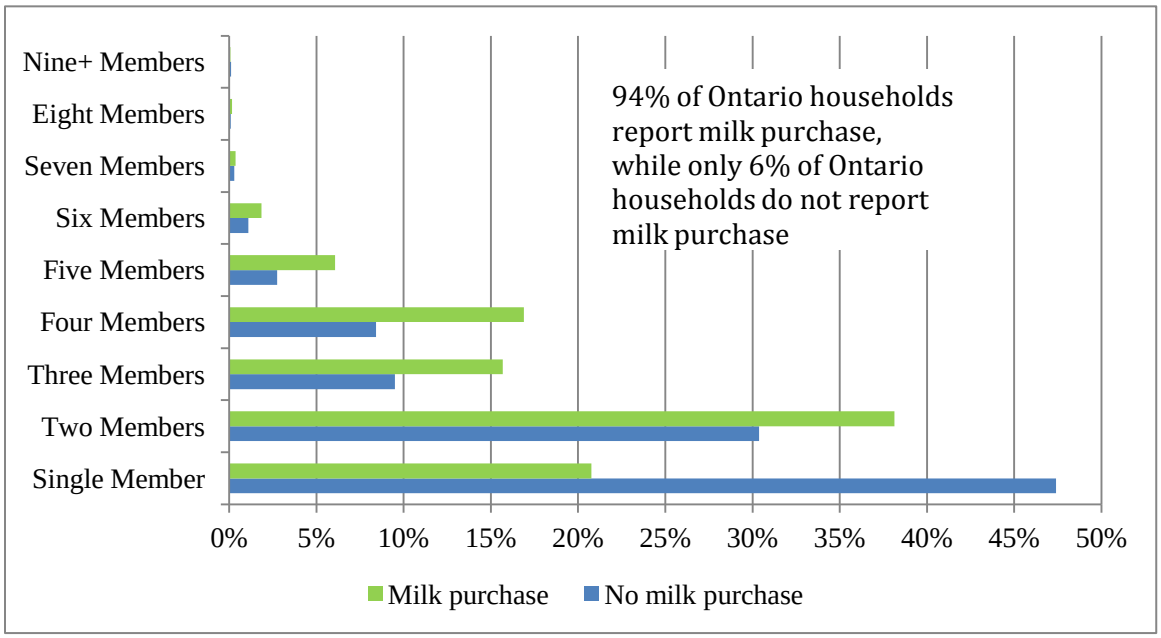


Figure A11 shows the break-down of milk purchase behavior across whether there children of particular ages are in the home. Amongst non-purchasers of milk, over 80% do not have children under 18 years of age in the home. Amongst purchasers of milk, 70% do not have children under 18 in the home. Moreover, the proportion of households reporting milk purchase is about twice as high as those households who do not report cheese purchase when there are children in their teen years (13 to 17 years of age) in the home.

Figure A11: Percent of non-milk purchasing and milk purchasing Ontario households, by presence of children in the home

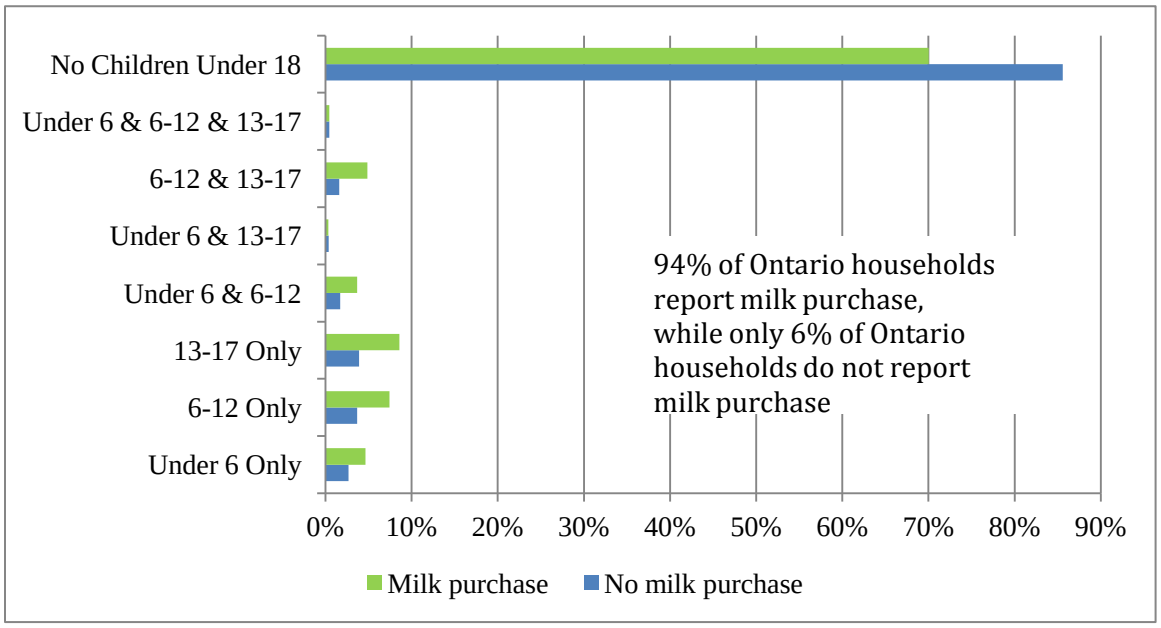
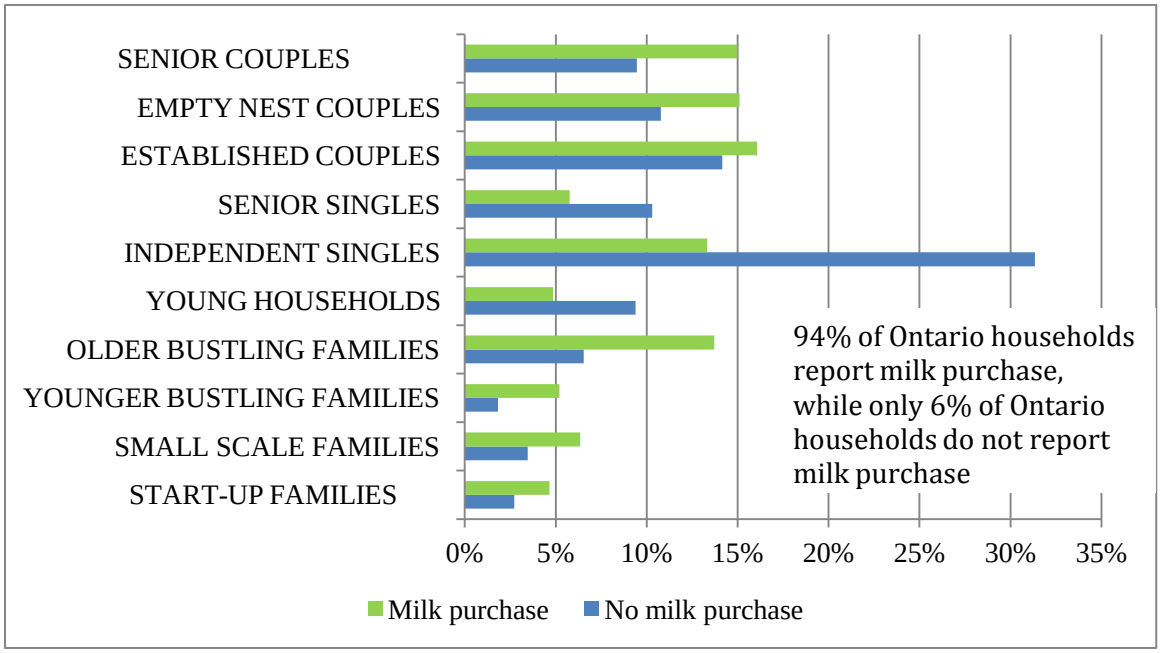


Figure A12 shows the breakdown of household milk purchase behaviour across the various categories in Neilson's life-stage measure. Amongst households that do not report the purchase of milk, the majority come from households in the single individuals and younger households categories. Within the other life-stage categories, the likelihood of purchasing milk is higher than the likelihood of not purchasing milk.

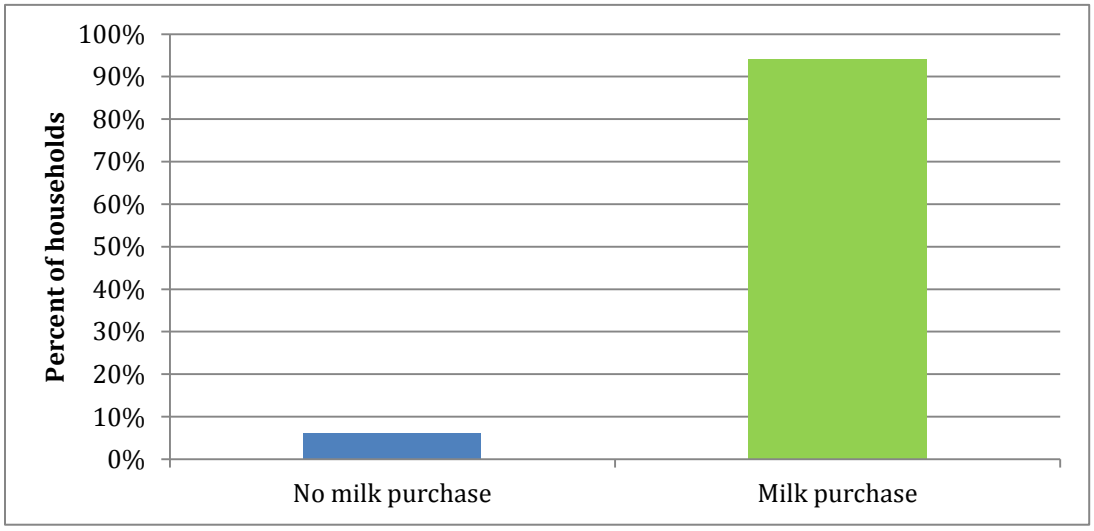
Figure A12: Percent of non-milk purchasing and milk purchasing Ontario households, by life-stage



7.1.3. Fluid Milk in the Maritimes

As shown in Figure A13, that 96 percent of the households in the Maritime sample (n=24,256) report purchasing milk, while only four percent report not purchasing milk.

Figure A13: Percent of Maritime households reporting either no milk purchase or milk purchase, 2007-2011



Regarding household composition, Figure A14 shows the breakdown of Maritime household's reported milk purchase behavior plotted against Homescan's household composition characteristics. Amongst both milk purchasers and non-purchasers, the lion's share were married. Note too that after households with married couples, the next most frequent group reporting non-consumption of milk are those who live alone.

Figure A15 shows the proportion of households reporting the purchase or non-purchase of milk versus household income ranges. As with cheese and milk in Ontario, households with the lowest income category have the highest frequency of non-purchase. Note too that the frequency of purchasing milk falls as household income rises (as it does for non-purchasers as well). The frequency of milk purchase is higher than the frequency of not purchasing milk for households with income higher than $40,000.

Figure A14: Percent of non-milk purchasing and milk purchasing Maritime households, by household composition

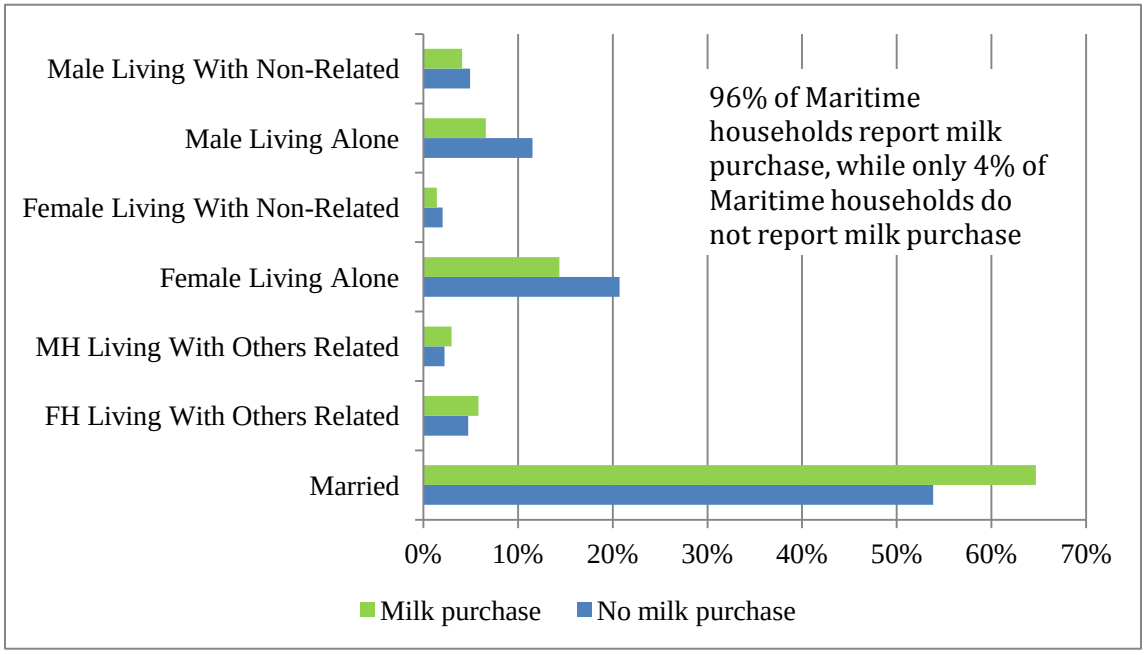


Figure A15: Percent of non-milk purchasing and milk purchasing Maritime households, by household income

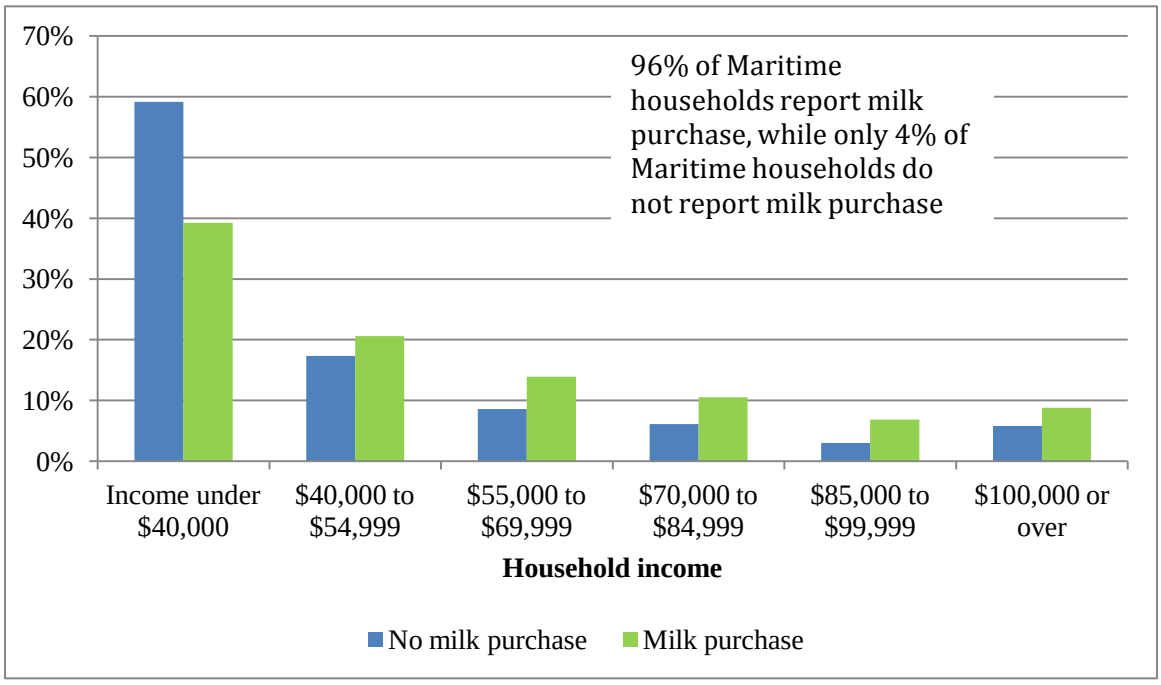


Figure A16 shows the breakdown of households according to milk purchase versus household size. Households with two people have the highest frequency of reporting purchasing of milk, as well as not purchasing milk. Single person households have the next highest frequency for both purchase and non-purchase of milk, followed by households with three or four members.

Figure A16: Percent of non-milk purchasing and milk purchasing Maritime households, by household size

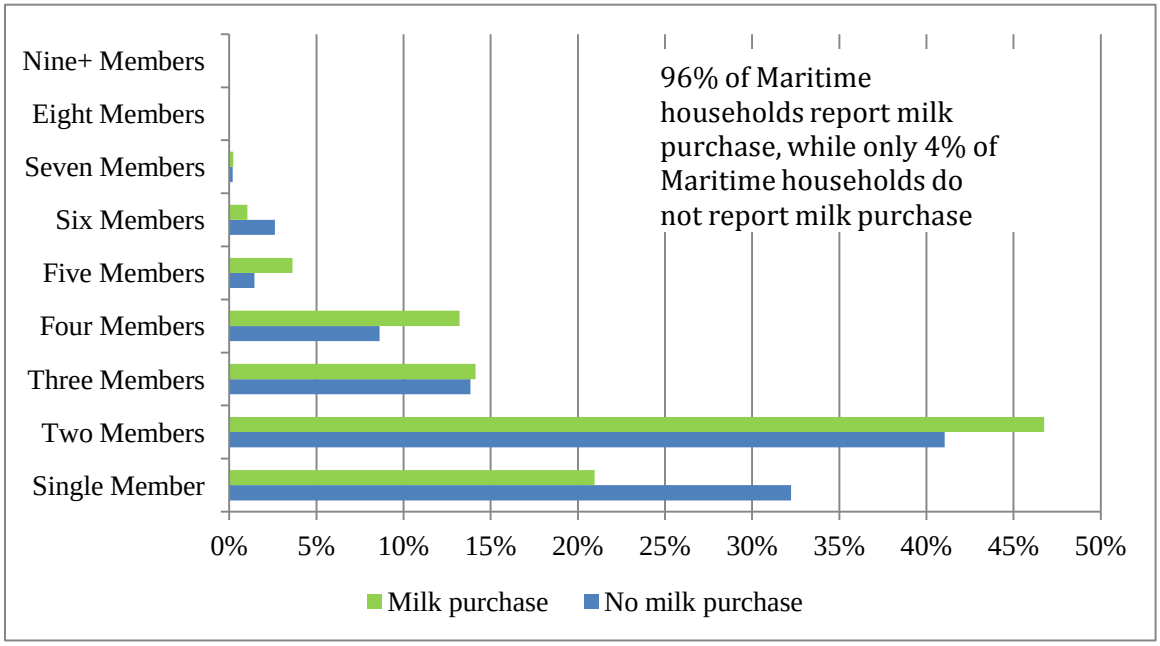


Figure A17 shows the break-down of milk purchase behavior across whether there are children of particular ages in the home. Amongst non-purchasers of milk, over 80% do not have children under 18 years of age in the home. Amongst purchasers of milk, slightly more than 75% do not have children under 18 in the home. Nonetheless, the presence of children under 18 years of age in the home generally increases the frequency of reporting milk purchase compared to the frequency of not purchasing milk. Moreover, the frequency of reporting milk purchases is about twice as high as reporting non-milk purchase when there are children in their teen years (13 to 17 years of age) in the home.

Figure A18 shows the breakdown of household's milk purchase behaviour across the various categories in Neilson's life-stage measure. Results here are somewhat different from cheese, and milk in Ontario. The most frequent non-purchasers of milk are households in the single individuals and established couples group, followed by empty nesters and senior couples. Interestingly, these are also the same life-stage categories with the highest frequency of also reporting milk consumption.

Figure A17: Percent of non-milk purchasing and milk purchasing Maritimes households, by presence of children in the home

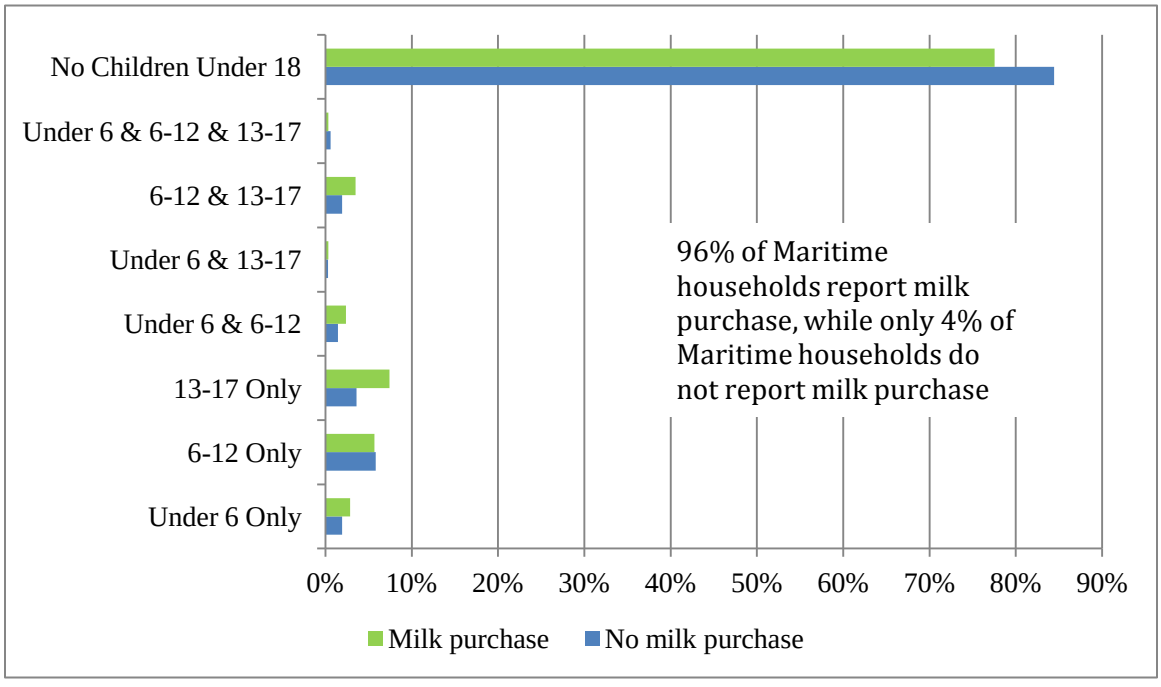
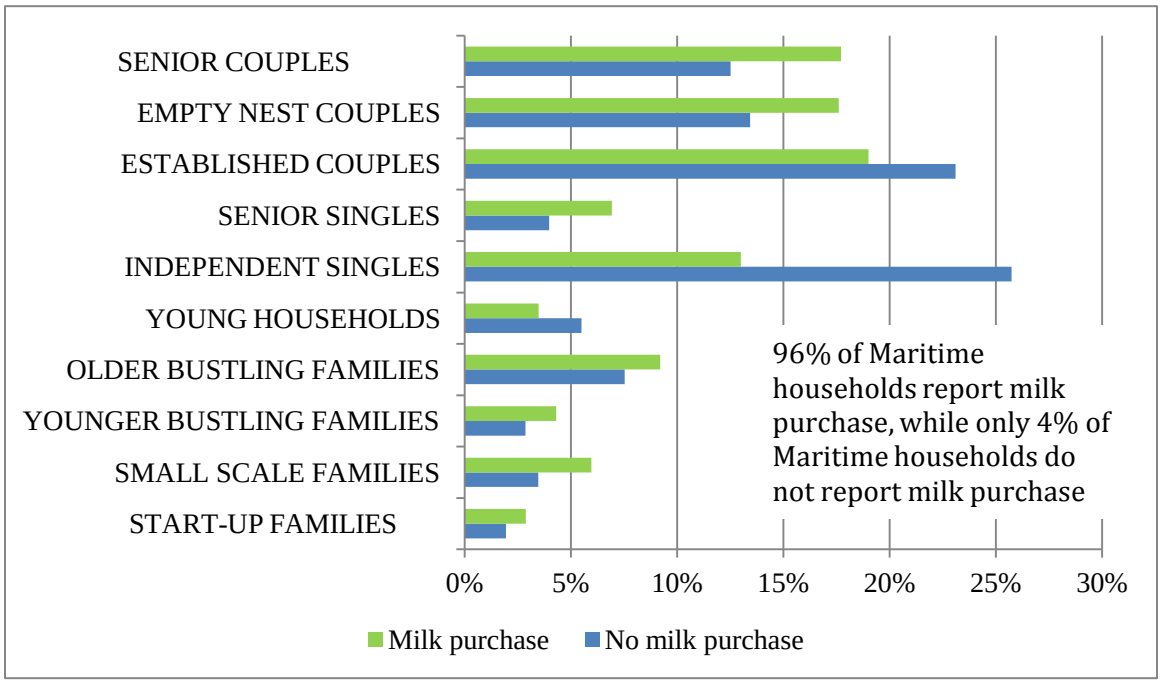


Figure A18: Percent of non-milk purchasing and milk purchasing Maritime households, by life-stage



8. TECHNICAL APPENDIX

Table TA.1: Annual average of the data used in the cheese model

	2007	2008	2009	2010	2011
Cheese's share	0.405	0.407	0.404	0.409	0.407
Meat's share	0.595	0.593	0.596	0.591	0.593
Cheese price	14.734	14.786	14.829	14.940	14.693
Meat price	28.533	29.176	29.255	29.194	29.796
Protein expenditure	138.789	142.118	147.567	146.219	145.839
Dummy variable for non-English language	0.044	0.044	0.042	0.038	0.037
Dummy variable for married couple	0.640	0.667	0.672	0.667	0.656
Household size	2.554	2.506	2.495	2.506	2.535
Dummy variable for head aged under 35	0.086	0.082	0.080	0.070	0.068
Dummy variable for head age over 50	0.562	0.581	0.607	0.615	0.619
Dummy variable for no children in the home	0.704	0.721	0.737	0.736	0.725
Maritimes dummy variable	0.174	0.168	0.169	0.168	0.166
Manitoba/Sask dummy variable	0.139	0.142	0.140	0.142	0.142
Alberta Dummy variable	0.143	0.139	0.143	0.141	0.139
BC dummy variable	0.124	0.131	0.126	0.129	0.132
Count of border crossings	15.566	15.654	14.089	16.223	18.458
TPR	0.378	0.375	0.398	0.431	0.455
DFC investment in advertising[a]	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
DFC investment in promotion[a]	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
DFC investment in nutrition communication[a]	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
Branded cheese media in all but Quebec	1031682	1003855	653846.8	1122638	1097885

a Not shown for confidentiality reasons

Table TA.2: Annual average of the data used in the Ontario model

	2007	2008	2009	2010	2011
Milk's share	0.416	0.416	0.396	0.398	0.396
Dairy alt's share	0.155	0.153	0.143	0.142	0.143
Flavoured soft drink's share	0.241	0.235	0.252	0.255	0.261
Juice's share	0.320	0.321	0.324	0.314	0.310
Milk price	1.393	1.414	1.369	1.386	1.441
Dairy alt. price	8.825	8.700	8.702	8.476	8.377
Flavoured soft drink price	0.860	0.882	0.948	0.947	0.924
Juice price	2.616	2.533	2.576	2.430	2.334
Beverage expenditure	124.554	125.067	127.211	122.458	121.332
Dummy variable for non-English language	0.048	0.044	0.052	0.047	0.042
Dummy variable for married couple	0.695	0.731	0.742	0.726	0.713
Count of border crossings	2.299	2.265	2.028	2.282	2.498
TPR	0.097	0.147	0.154	0.077	0.133
DFC investment in advertising[a]	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
DFC investment in promotion[a]	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
DFC investment in nutrition communication[a]	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
Branded milk media in Ontario	621476.6	510556.6	156407.8	951108.9	897463.2

a Not shown for confidentiality reasons

Table TA.3: Annual average of the data used in the Maritime model

	2007	2008	2009	2010	2011
Milk's share	0.479	0.488	0.459	0.463	0.461
Dairy alt's share	0.127	0.131	0.125	0.125	0.129
Flavoured soft drink's share	0.216	0.215	0.242	0.234	0.234
Juice's share	0.281	0.276	0.274	0.268	0.274
Milk price	1.754	1.817	1.835	1.817	1.828
Dairy alt. price	8.957	9.036	8.956	8.602	8.477
Flavoured soft drink price	0.868	0.847	0.952	0.931	0.913
Juice price	2.659	2.392	2.319	2.610	2.546
Beverage expenditure	126.406	125.370	130.511	124.360	121.108
Dummy variable for non-English language	0.105	0.104	0.093	0.087	0.082
Dummy variable for married couple	0.668	0.702	0.723	0.732	0.735
Household size	2.636	2.609	2.568	2.547	2.667
Dummy variable for head aged under 35	0.089	0.080	0.086	0.045	0.057
Dummy variable for head age over 50	0.535	0.555	0.586	0.655	0.630
Dummy variable for no children in the home	0.664	0.700	0.733	0.740	0.697
Count of border crossings	2.309	2.215	1.833	2.006	2.165
TPR	0.035	0.021	0.078	0.058	0.072
DFC investment in advertising	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
DFC investment in promotion	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
DFC investment in nutrition communication	xxxxx	xxxxx	xxxxx	xxxxx	xxxxx
Branded milk media in the Maritimes	57210.96	27768.31	25545.29	74563.55	116829.4

a Not shown for confidentiality reasons

Table TA.4: Estimated parameters and t-statistics for the Canada protein model[a,b]

	Estimate	p-value
Intercept	1.1376	0.531
Log of cheese price	-0.0340	0.000
Log of expenditure on protein sources	-0.0793	0.000
Log of DFC investment in advertising	0.0001	0.981
Log of DFC investment in promotion	0.0031	0.138
Log of DFC investment in nutrition communication	0.0025	0.007
Log of branded cheese media in all but Quebec	0.0022	0.343
TPR	0.0610	0.013
Count of border crossings	-0.0001	0.771
Dummy variable for non-English language	-0.0065	0.290
Dummy variable for married couple	0.0204	0.000
Household size	0.0122	0.000
Dummy variable for head aged under 35	0.0157	0.000
Dummy variable for head age over 50	-0.0219	0.000
Dummy variable for no children in the home	-0.0225	0.000
Year	-0.0003	0.771
Dummy variable for quarter 1	0.0064	0.013
Dummy variable for quarter 2	0.0023	0.315
Dummy variable for quarter 4	0.0086	0.000
Maritimes dummy variable	-0.0629	0.000
Manitoba/Sask dummy variable	0.0342	0.000
Alberta Dummy variable	0.0387	0.000
BC dummy variable	0.0445	0.000
Inverse mills ratio	0.0621	0.355

a. The test of the null hypothesis that all slope coefficients were jointly equal to zero was less than 0.001.
b. P-values less than 0.001 are reported as 0.000

Table TA.5: Estimated parameters and t-statistics for the Ontario beverage model[a,b]

	Milk		Dairy alternatives		Flavoured soft drinks	
	Estimate	p-value	Estimate	p-value	Estimate	p-value
Intercept	13.1503	0.000	11.1971	0.001	-13.4413	0.000
Log of milk price	-0.0807	0.000				
Log of dairy alt. price	0.0441	0.000	-0.0302	0.000		
Log of flavoured soft drink price	0.0136	0.000	0.0554	0.000	-0.0118	0.000
Log of beverage expenditure	-0.0153	0.000	-0.1057	0.000	0.0616	0.000
Log of DFC investment in advertising	0.0019	0.643	0.0047	0.544	-0.0096	0.053
Log of DFC investment in promotion	0.0097	0.003	-0.0081	0.159	-0.0252	0.000
Log of DFC investment in nutrition communication	0.0040	0.011	-0.0019	0.421	-0.0082	0.000
Log of branded milk media in Ontario	0.0066	0.001	0.0076	0.010	0.0024	0.198
TPR	0.0060	0.192	0.0021	0.736	0.0108	0.006
Count of border crossings	0.0008	0.180	0.0004	0.634	0.0006	0.428
Dummy variable for non-English language	0.0222	0.000	-0.0127	0.110	-0.0682	0.000
Dummy variable for married couple	0.0410	0.000	-0.0109	0.020	-0.0326	0.000
Year	-0.0063	0.000	-0.0051	0.002	0.0066	0.000
Inverse mills ratio	0.0471	0.197	-0.1272	0.000	0.2738	0.000

a. The test of the null hypothesis that all slope coefficients were jointly equal to zero was less than 0.001.
b. P-values less than 0.001 are reported as 0.000

Table TA.6: Estimated parameters and t-statistics for the Maritime beverage model[a,b]

	Milk		Dairy alternatives		Flavoured soft drinks	
	Estimate	p-value	Estimate	p-value	Estimate	p-value
Intercept	12.1987	0.084	31.6083	0.010	-19.4648	0.007
Log of milk price	-0.1075	0.000				
Log of dairy alt. price	0.0891	0.000	-0.0977	0.000		
Log of flavoured soft drink price	0.0042	0.399	0.0320	0.000	-0.0199	0.000
Log of beverage expenditure	0.0468	0.000	-0.0923	0.000	-0.0254	0.000
Log of DFC investment in advertising	0.0015	0.876	0.0008	0.928	0.0063	0.393
Log of DFC investment in promotion	0.0218	0.029	0.0063	0.451	-0.0200	0.190
Log of DFC investment in nutrition communication	0.0093	0.007	0.0027	0.370	-0.0094	0.002
Log of branded cheese media in all but Quebec	-0.0037	0.473	-0.0025	0.582	0.0008	0.858
TPR	0.0431	0.763	0.0558	0.665	-0.1044	0.423
Count of border crossings	0.0109	0.198	0.0076	0.294	-0.0112	0.104
Dummy variable for non-English language	-0.0413	0.000	0.0255	0.047	-0.0115	0.118
Dummy variable for married couple	-0.0062	0.668	0.0286	0.018	-0.0128	0.217
Household size	-0.0165	0.000	0.0280	0.020	0.0087	0.217
Dummy variable for head aged under 35	-0.0056	0.573	-0.0581	0.001	-0.0097	0.286
Dummy variable for head age over 50	0.0101	0.169	-0.0398	0.090	0.0001	0.995
Dummy variable for no children in the home	-0.0193	0.185	-0.0060	0.631	0.0530	0.000
Year	-0.0059	0.089	-0.0157	0.011	0.0098	0.007
Dummy variable for quarter 1	0.0233	0.093	-0.0411	0.122	-0.0344	0.018
Dummy variable for quarter 2	0.0036	0.531	-0.0144	0.027	0.0038	0.480
Dummy variable for quarter 4	-0.0023	0.787	-0.0883	0.024	-0.0039	0.637
Inverse mills ratio	-0.5249	0.224	0.6167	0.034	0.0147	0.911

a. The test of the null hypothesis that all slope coefficients were jointly equal to zero was less than 0.001.

b. P-values less than 0.001 are reported as 0.000

Table TA.7: OLS regressions results of single equation models for the auxiliary analysis

	Canada Cheese		Ontario milk		Maritime milk	
	Estimate	p-value	Estimate	p-value	Estimate	p-value
Intercept	18.830	0.476	3250.720	0.000	3498.370	0.000
Year	-0.008	0.565	-1.590	0.000	-1.729	0.000
Dummy variable for quarter 1	0.219	0.000	3.023	0.002	5.525	0.011
Dummy variable for quarter 2	0.021	0.534	1.074	0.098	1.073	0.193
Dummy variable for quarter 4	0.206	0.000	-0.098	0.899	0.844	0.361
Deflated cheese price	-0.761	0.000				
Deflated meat price	-0.019	0.000				
Deflated milk price			-215.985	0.000	-82.414	0.000
Deflate dairy alt. price			4.828	0.000	9.247	0.000
Deflated flavoured softdrink price			3.042	0.373	6.904	0.287
Deflated juice price			-0.177	0.756	-0.164	0.834
DFC investment in advertising	0.003	0.016	1.339	0.275	1.124	0.477
DFC investment in promotion	0.014	0.666	0.632	0.464	0.160	0.892
DFC investment in nutrition communication	0.014	0.303	0.462	0.112	0.451	0.338
Branded cheese media in all but Quebec	0.043	0.242	0.479	0.241	0.646	0.339
TPR	0.129	0.722	0.846	0.292	14.521	0.467
Count of border crossings	-0.016	0.016	-0.114	0.600	1.013	0.422
Maritimes dummy variable	-0.559	0.000				
Manitoba/Sask dummy variable	0.006	0.966				
Alberta dummy variable	0.017	0.910				
BC dummy variable	-0.072	0.458				
Dummy variable for non-English language	-0.223	0.000	0.237	0.818	-4.012	0.000

Dummy variable for married couple	0.655	0.000	5.947	0.000	8.572	0.000
Household size	0.666	0.000	5.742	0.000	5.705	0.000
Dummy variable for head aged under 35	-0.227	0.000	-7.149	0.000	-4.946	0.000
Dummy variable for head age over 50	-0.028	0.257	0.102	0.847	-0.021	0.979
Household income between $40,000 and $54,999	0.183	0.000	0.115	0.874	1.509	0.085
Household income between $55,000 and $69,999	0.372	0.000	0.984	0.197	4.379	0.000
Household income between $70,000 and $84,999	0.415	0.000	-0.010	0.989	0.971	0.406
Household income between $85,000 and $99,999	0.623	0.000	2.166	0.009	5.474	0.000
Household income $100,000 or higher	0.610	0.000	3.128	0.000	0.656	0.591
Children 12 years of age or younger in home	-0.191	0.000	3.973	0.000	-2.107	0.042
Children between 13 & 17 years of age in home	0.486	0.000	4.942	0.000	6.521	0.000
Number of observations	110144		23756		8449	
F-statistic (p-value)	773.663	(0.000)	249.442	(0.000)	315.778	(0.000)
Adjusted-R^2	0.164		0.21		0.151	