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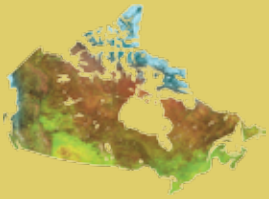

Causal factors behind household expenditure leakage and its effect on community resource dependence in Quebec

D. H. Kuhnke and W. A. White

INFORMATION REPORT NOR-X-418

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ABSTRACT

The term "resource-dependent community" denotes a rural community dependent on one or several resource-based industries for most of its economic livelihood. However, the concept of resource dependence can be broadened to describe a community's degree of dependence on all base and nonbase sectors that make up its economy. In this study, sector dependence indices based on location quotients were used to examine the effect of household expenditure within and outside of communities associated with the Bas-Saint-Laurent Model Forest in Quebec on traditional interpretations of community resource dependence. The causal factors behind household expenditure leakage were also investigated through ordinary least-squares modeling to determine linkages between dependence and characteristics of both the community and its households. The study revealed that traditional sector dependence indices based on employment and income are biased when dependence is examined in a larger context. The sector of employment also had little bearing on leakage except through income. Family structure, home community population, travel distances, and education were the main causal factors driving the degree of household expenditure leakage.

RÉSUMÉ

L'expression « collectivité dépendante des ressources » désigne une collectivité rurale dont la survie économique dépend principalement d'une ou plusieurs industries liées à l'exploitation d'une ressource naturelle. Toutefois, le concept de « dépendance » peut être élargi pour comprendre la mesure dans laquelle une collectivité dépend de l'ensemble des secteurs qui composent son économie. Dans la présente étude, les indices de dépendance à l'égard des secteurs basés sur les coefficients de localisation ont été utilisés pour examiner l'effet des dépenses des ménages au sein et à l'extérieur des collectivités de la Forêt modèle du Bas-Saint-Laurent sur les interprétations traditionnelles de la dépendance des collectivités par rapport aux ressources. Les facteurs agissant sur la fuite des dépenses des ménages ont également été examinés à l'aide de la méthode des moindres carrés ordinaires en vue de déterminer les liens entre la dépendance et les caractéristiques de la collectivité et de ses ménages. L'étude a révélé que les indices traditionnels de dépendance à l'égard des secteurs sont faussés lorsque la dépendance est examinée dans un contexte élargi. Le secteur d'emploi a peu d'incidence sur la fuite, sauf dans le cas des revenus. La structure familiale, la population de la collectivité, les distances de déplacement et l'éducation étaient les principaux facteurs influant sur le degré de fuite des dépenses des ménages.

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INTRODUCTION

Hundreds of rural communities across Canada depend on one or more industries associated with natural resources for most or all of their economic livelihood. Because of the importance of natural resources to the Canadian economy, these resource-dependent communities have been the subject of many studies investigating the relationship between community well-being and dependence on the resource sector. In recent years, however, the widespread adoption of sustainable development as a guiding ethic in resource management has led to questions about what dependence really means. This has in turn resulted in a logically broader interpretation of dependence to mean the degree to which a community depends on all of the sectors that make up its economy, not just the base sectors (where base sectors are the sectors that draw in employment or income from outside the community or region, usually through the export of goods).

Although there is no universally accepted method for determining the degree to which resource-dependent communities actually depend on the resource sector, this broader view of dependence has given rise to a need to identify the level and type of sector dependence. Studies by Fletcher et al. (1991), Horne and Penner (1992), Horne and Robson (1993), Jagger et al. (1998), Korber et al. (1998), Williamson et al. (1999), and Stedman et al. (2005) are examples of the many Canadian contributions to the literature on community dependence. Employment data, which were used by Stedman et al. (2005), for example, are readily available from the Census of Canada, but employment figures alone do not account for income differences between various sectors. In particular, income-based measures of dependence could be prone to misinterpretation because of the common assumption that income earned in a community is spent within that community (Jagger et al. 1998). Jagger et al. (1998) investigated the utility of household expenditure leakage as an indicator of the severity of effects that an economic shock is likely to have on a community. A high level of leakage may mean that the effect of an economic shock will be felt to a greater extent outside the community than would be the case for a community where most purchases are made locally.

In this report, we briefly review the literature on community dependence and its measurement and then investigate the interrelationships among three methods of dependence measurement within an economic base modeling framework. This analysis is intended to demonstrate that traditional measures of dependence, which are based on income and employment alone, are biased or inaccurate because they do not account for the effects of income leakage. We contend that accounting for leakage within an economic base modeling framework portrays a more complete description of community dependence. This work is based on a survey of households from communities within the Bas-Saint-Laurent Model Forest, a region of Quebec that is believed to be heavily dependent on resource-based industries such as forestry and agriculture, including maple syrup production.

COMMUNITY DEPENDENCE AND ITS MEASUREMENT

The dependence of communities on extraction or harvests of natural resources has been the subject of much study by numerous scholars and researchers, especially in the United States, including pioneering early works such as that by Kaufman and Kaufman (1946). Much of this study has been spurred by academic interest in the paradox of poverty in the midst of resource abundance, sometimes referred to as the resource curse (Ross 1999). It has long been noted that resource-dependent communities suffer from a range of social ills, including poverty (however defined), high unemployment, low income, and low human capital (Stedman et al. 2004; Leake et al. 2006), although considerable variation, according to the type of resource (forests, minerals, etc.), the region, and other factors, has been reported (Stedman et al. 2004). Much of the research in this area has therefore investigated the relationship between a community's natural resource dependence and its well-being or relative lack thereof.

Some might question the rationale for an interest in the well-being of resource-dependent communities and, by extension, the well-being of their residents. A recent estimate put the number of Canadian forest-dependent communities in 2001 at 324, but this figure refers specifically to communities with at least 50% of total base income coming from forestry (Stedman et al. 2007). In addition, almost 893 000 Canadians were directly or indirectly employed in 1999 in the forestry sector (Natural Resources Canada 2009). Forestry and its related industries, as well as other natural resource-based industries such as mining and fishing and their related industries, provide employment and livelihoods for many Canadians. The social and economic well-being of Canadians employed in these resource-based industries and living in the many associated resource-dependent communities cannot therefore go unnoticed in a nation heavily dependent on natural resources for its overall economic well-being. This heavy dependence is perhaps best explained by staples theory, the economic logic generally thought to best explain the manner in which the nation's economy developed. According to staples theory, first espoused by Canadian economic historian Harold Innis (1894–1952), the country's generous but far-flung and difficult-to-access endowments of natural resources led to a largely resource-based economy that now supplies raw or semiprocessed materials to established industrial centers in central Canada, the United States, Europe, and Japan. As a result, many rural communities became established across Canada to provide the social and economic nexus for the harvest or extraction of one or more resources.

Traditional measures of dependence have concentrated on readily available (and relatively inexpensive) economic data, chiefly data for employment and income, which are arguably important contributors to community and individual well-being. The distribution of income within or between communities is also often used as an indicator of well-being. Economists tend to favor the use of income rather than numbers of people employed, as the income associated with various jobs is not uniform (Stedman et al. 2007). Higher proportions of well-paying jobs may indicate greater well-being. These economic data also have an important temporal aspect, as they are collected periodically by state agencies like Statistics Canada and the US Census Bureau. Comparisons of the proportion of employment or income that an industry represents within a community relative to the proportions for other industries (if there are any) within the same community, or relative to the proportions in other communities or regions, often form the basis for assessing dependence and well-being in resource-dependent communities.

An enhancement representing a more sophisticated approach to measuring dependence using employment or income data is the economic base model. Economic base theory was conceived in the 1920s and 1930s by various analysts and urban planners who required a method for estimating the total effect on a community caused by introduction or expansion of a base industry (Andrews 1953). The core of the model is the division of local economic activity into two sectors, the base sector and the nonbase sector. The base sector consists of activity that brings in income from outside sources or that generates

employment from outside income, such as income resulting from goods exported from the community or region or money brought into the community or region by tourists or through transfer income. Horne and Robson (1993), in their analysis of British Columbia communities, identified the need to include nonemployment income (sourced from outside the community) in an examination of resource dependence, as they found that dependence on the resource sector was lower than had been estimated in an earlier study (Horne and Penner 1992). For example, in a pulp mill town the incomes of the mill workers are considered base incomes. The nonbase sector consists of the suppliers of goods and services to the pulp mill workers, namely, retail and grocery stores and the like, whose incomes come mostly from the spending of the pulp mill employees.

The economic base model should not be interpreted to mean that exports (or outside income) constitute the only factor determining the overall level of local economic activity (Power 1996). Overall local economic activity is also heavily influenced by the structure and character of the local economy itself, because of its role in determining the level of income leakage. In particular, not all of the income earned in the base sector is spent in the local nonbase sector, nor do those employed in the nonbase sector spend all of their disposable income locally. Income leakage forms the basis for determining impact multiplier, the ratio of nonbase to base income within a community or region, which are used in the economic base model to determine the extent to which a change in the base sector, experienced as either a positive or negative economic shock, causes a commensurate change in the nonbase sector. The more quickly injected income leaks out of the local economy, the smaller the multiplier (Power 1996). If there is income leakage in a small community, the effects of changes in employment and income may actually appear outside of the community (Robertson 2003). Williams (1996) observed that many local economies have substantial leakage because of development policies that cultivate the base sector of an economy with little regard for the extent to which leakage of income is taking place. Local consumer services can function as base activities by drawing income into the economy from outside, thus acting to prevent leakage (Williams 1996). Others have noted that the spatial scale used in examining dependence is important, for there exists a regional level of industrial diversification and a more complex network of economic and social relations that is less apparent when communities are studied in isolation (Randall and Ironside 1996). Although the effect of leakage is consistent with the economic base hypothesis, it may not be adequately accounted for in practical implementation (Robertson 2003), something that the current work is intended to address. In addition, a number of factors that contribute to the propensity of residents to purchase goods and services outside of their community are investigated here.

The economic base model can be actualized through a number of methods, including the minimum requirements approach and the location quotient technique, the latter of which was employed for the work reported here. The location quotient technique has a number of shortcomings, chief among them its high sensitivity to the level of sector aggregation and the absence of accounting for the existence of cross-trading or cross-hauling, which occurs in situations where communities concurrently import and export similar goods and services, as outlined by Robertson (2003). Some of these shortcomings have been addressed through a modification of the location quotient technique that accounts for imports and exports as discussed by Fletcher (1991), Korber et al. (1998), and White and Watson (White, W.; Watson, D. 2004. Natural resource based communities in Canada: an analysis based on the 1996 Canada Census. Internal report produced for the Winning In The 21st Century initiative of Natural Resources Canada. Can. For. Serv., North. For. Cent., Edmonton, AB). The level of sector aggregation is important because per capita consumption differs between regions because of varying incomes; as such, smaller sectors are generally preferred for this type of analysis, as noted, for example, by Schwartz (1982), who argued that errors arising from differences in consumption and productivity can be reduced if provincial rather than national employment levels are used. Another way to increase confidence in the interpretation of a location quotient is to use more than one reference economy for sector aggregation (Persky et al. 1993).

The number of forest-dependent communities across Canada was reported earlier in this document as 324, but other researchers have arrived at different figures, depending not only on the measurement method but also on the rationale, if one was used or provided, for delineating dependence from nondependence. One of the earlier Canadian efforts on community resource dependence (DREE 1979) used a two-stage approach in which dependence varied with community population. White et al. (1986) expanded on this approach by adding economic diversity criteria for communities in British Columbia. Pharand (1988) described the demographic characteristics of forest-dependent communities across Canada using an approach to defining dependence similar to that used by DREE (1979). In the United States, 20% of total employment has traditionally been used as the cutoff for high levels of resource dependence in any particular sector; however, many researchers use a 10% criterion, because the 20% cutoff often results in too few cases for regional analyses (Stedman et al. 2004). Application of the 10% criterion yielded a total of 918 forest-dependent communities across Canada (Stedman et al. 2005). Randall and Ironside (1996) found a direct relationship between the degree of dominance of a resource sector and distance to the nearest Canadian metropolis, although there was considerable variation between resource sectors and, in the case of forestry, considerable variation within the sector.

One source of variation within the forestry sector is its segmented nature. This sector is made up of several subsectors, such as logging, lumber, and pulp and paper, which generally confer different levels of well-being to their employees depending on whether they are core or peripheral industries. Core industries are represented by large, well-capitalized firms that may enjoy oligopolistic or oligopsonistic status within their industries and may dominate their product markets (Overdevest and Green 1995). These industries contribute to enhanced community well-being through the provision of stable, year-round employment, higher incomes, and fringe benefits to their employees, which peripheral firms cannot provide; however, the core sector has become increasingly mobile and may not be as beneficial in the long run as it is in the short run (Overdevest and Green 1995). Peripheral firms often supply raw materials to core firms; the relationship between logging companies and pulp and paper firms is a classic example. However, it is not always the case that peripheral firms are associated with lower well-being. For example, in British Columbia, the logging and lumber sectors, along with the pulp and paper sector, have a positive association with well-being, because of a number of factors, including the nature of the resource and high rates of unionization (Parkins et al. 2003).

Aside from any discussion of measurement methods or market segmentation, the literature reveals that resource-dependent communities share several fundamental characteristics. The bulk of their economic livelihood stems from one or several industries engaged primarily in the extraction or harvest of natural resources; they tend to have smaller populations than larger urban centers; they are removed, though not necessarily isolated, from larger urban centers; and they suffer a range of social ills that are more pronounced than those of larger urban centers or the nation as a whole. Innis (1950) used a meteorological metaphor, cyclones, to represent the whirlwind frenzy of capitalist accumulation at extraction sites and the equally frenetic decline and destruction that follow. In this setting, it is the vicissitudes of boom-and-bust cycles that are generally the source of economic shocks, which affect resource-dependent communities more than they do the broader nation. For resource-dependent communities in particular, sustainability hinges on the ability to deal with change, to reconfigure available resources, and to recombine financial capital, local skills, and natural resources in ways that create sustainable livelihoods (Beckley et al. 2002). The point of describing all these methods and decision criteria for community dependence and well-being is to emphasize that the method and criteria chosen are primarily a function of the researcher's intentions, as influenced by available data, research budgets, and the works of previous researchers. Each method has pros and cons, and this work seeks to address an often overlooked aspect of one of them.

RESEARCH QUESTIONS

Estimates of sector dependence in some of the studies mentioned above relied on economic base models rather than simple percentages of income or employment. The advantage of economic base models is their basic tenet that communities depend on base employment, not on total employment (since total employment includes nonbase employment, which is irrelevant to dependence). The percentage of a resource industry's base employment relative to total base employment may be a more accurate measure of resource dependence than percentages of total employment. Another advantage of economic base models, from the viewpoint of community development or planning, is that they can generate an estimate or indication of the economic impacts on a region or community that will result from policy decisions or exogenous economic shocks.

Economic base models can also be constructed using income instead of or in addition to employment; however, it seems essential that some accounting of income leakage be undertaken to obtain a more accurate picture of resource dependence. Given the importance of accounting for income leakage in economic base models, one of the research questions for this work was "What drives the degree of income leakage?" Also, given that estimates of income leakage are already available, what effect do these leakages have on measures of community dependence that are based on base income and employment? In this study, the interrelationships among three methods of measuring dependence within an economic base modeling framework were investigated to highlight the potential biases inherent in measures of dependence based on income and employment alone. First, details are provided concerning the source of data for this work. The models used to address the research questions are then described, and the findings presented. The report ends with a summary and conclusions section.

CANADIAN FOREST SERVICE SURVEY OF HOUSEHOLD EXPENDITURES IN MODEL FOREST COMMUNITIES

Survey Methods

In 1998 and 1999, the Canadian Forest Service (CFS) conducted nationwide surveys that sampled households in communities close to or within all 11 model forests across the country. The chief aim of these surveys was to gather baseline data on residents' expenditures within and outside their respective communities, to allow examination of community dependence from the perspective of leakage expenditures. These analyses were intended to complement traditional employment and income data. The surveys were conducted by telephone, on the basis of randomly selected telephone numbers for residents in the model forest communities. The respondents were asked where they usually purchased durable and nondurable goods and services. The list of goods and services used in the survey was based mostly on Statistics Canada's standard 18 classes of household durable and nondurable goods and services. Expenditure data from 2 of these 18 classes were additionally assigned to 2 more product classes created by the authors. These assignments were made because information available before the survey began suggested that particular types of goods within each of the two Statistics Canada classes were often purchased at locations outside the community. A response category for purchases made using the Internet was included for eight classes of nondurable and durable goods and services; these purchases were considered to have been sourced from outside the general area of the model forest. Nondiscretionary goods and services, such as rent, mortgage payments, taxes, and utilities, were omitted from the survey, because respondents did not have a choice about where to make such expenditures. The survey also included socioeconomic questions about household income, respondent's age and level of education, family characteristics, the sector of employment (forestry, mining, service industry, etc.) of each adult within the household, and the

number of unemployed adults in the household. Respondents were also asked about their motivation for making purchases in different locations. The survey instrument appears in Appendix 1.

An underlying feature of these household expenditure surveys was the assumption that, for respondents who stated that the home community was where they usually purchased items in a particular product class (e.g., food from grocery stores), 100% of items in that product class were purchased within the home community. In reality, the respondent might purchase 80% of groceries in the home community and 20% outside the community. Asking respondents to estimate the split in spending between their home community and various destination communities would have added a great deal of subjectivity to the responses, which might in turn have led to estimated dollar values that were no closer to the actual values than those achieved with the existing method. Perhaps more importantly, asking respondents for an estimated split for all product classes would have made the telephone interview longer than most respondents would have found acceptable. The implicit assumption behind the all-or-nothing survey questions was that the large sample size would minimize any bias introduced by this approach.

The work reported here is based on the survey conducted in the Bas-Saint-Laurent Model Forest (BSLMF) of Quebec. The BSLMF differed from the other model forests in important ways. All of its three sections (Fig. 1), covering a total area of 113 200 ha, were made up of private woodlots or tenant farms leased from a corporate landowner (Abitibi-Consolidated). The BSLMF lay within the Great Lakes – St. Lawrence forest region, which is dominated by stands of maple (*Acer* spp.), balsam fir (*Abies balsamea* (L.), and yellow birch (*Betula alleghaniensis* Britt.).

Survey Results

The BSLMF survey sample totaled 2 082 households, or 13.4% of the total number of households among the sampled communities. For various reasons, calls to 509 of the telephone numbers did not lead to interviews: the call produced a busy signal; the number was for a fax machine, modem, or pager; the number was for a business rather than a household; or no French or English was spoken in the household. Some communities were later dropped from the study because they had too few eligible households to represent a sufficient sample size for determination of a sector dependence index, as described later. This is partly why the 18 communities shown in Table 1 are not the same as those listed in Appendix 1. In addition, some of the communities listed in Appendix 1 were subsequently found to be part of larger census subdivision (CSD) and therefore crucial pieces of information for modeling purposes for these communities were indistinguishable from the CSDs. Other respondents had to be dropped from the sample because too many ambiguous destination communities were given among the various product classes to permit leakage modeling. Finally, the survey included respondents living in larger centers such as Rimouski, which were later deemed to lie outside of the model forest area; those respondents were also dropped from the final sample. As a result of these exclusions, the final sample size for this work was 499.

The 18 communities that were considered to be associated with the BSLMF in the final sample either were within one of the three areas of the model forest or appeared to form part of a distinct cluster of communities in close proximity to one of the three areas. Destination communities (communities cited by survey respondents as sources of goods and services) were classified as part of the BSLMF study area (which could be, but were not limited to, one or more of the remaining 17 sampled communities) or outside of the study area (Table 1). Edmundston (in New Brunswick), Rimouski, and Rivière-du-Loup were the urban centers outside of the BSLMF that were visited most frequently by survey respondents for the purchase of various goods and services. The city of Québec was the major metropolitan area (> 100 000 residents) closest to the study area, but some respondents traveled as far as Montréal to purchase various goods and services. Fourteen of the communities in the survey sample were small, with a population under 700, while a few larger communities lead to the sample median of 1658.The number and spatial concentration of communities associated with the model forest was higher than for most other Canadian model forests. Information about communities, such as their populations, was based on Statistics

Table 1. Communities and their populations in the Canadian Forest Service survey of household expenditures for the Bas-Saint-Laurent Model Forest (BSLMF)

Communities surveyed in BSLMF	Population	Destination communities in BSLMF (not surveyed)	Population	Destination communities not in BSLMF (not surveyed)	Population
Auclair	520	Cabano	3 213	Amqui	6 473
Biencourt	619	Le Bic	2 872	Causapscal	2 634
Dégelis	3 317	Lejeune	381	Edmundston	17 373
Esprit-Saint	453	Les Hauteurs	589	Luceville	1 351
La Rédemption	536	Saint-Fabien	1 848	Matane	11 635
La Trinité-des-Monts	295	Saint-Gabriel	2 775	Mont-Joli	5 886
Lac-des-Aigles	657	Saint-Léon-le-Grand	1 114	Mont-Lebel	334
Notre-Dame-du-Lac	2 152	Saint-Michel-du-Squatec	1 332	Montréal	1 039 534
Saint-Charles-Garnier	322	Sainte-Angèle-de-Mérici	1 066	Pohénégamook	3 097
Saint-Cléophas	380	Sainte-Jeanne-d'Arc	1 128	Québec	169 076
Saint-Eugène-de-Ladrière	474			Rimouski	35 561
Saint-Guy	106			Rivière-Bleue	1 477
Saint-Juste-du-Lac	657			Rivière-du-Loup	17 772
Saint-Médard	281			Saint-Hyacinthe	38 739
Saint-Narcisse-de-Rimouski	1 009			Saint-Antonin	3 395
Saint-Valérien	862			Saint-Jacques	3 692
Saint-Zénon-du-Lac-Humqui	434			Saint-Jean-de-Dieu	1 768
Sainte-Irène	323			Saint-Marc-du-Lac-Long	469
				Saint-Pascal	3 643
				Sainte-Blandine	2 218
				Sayabec	1 999
				Sorel	36 786
				Trois-Pistoles	3 635
				Val-Brillant	997
Total population	13 397		16 318		1 409 544

Canada's CSDs. The locations of most of these communities are shown in Figure 1.

Descriptive information on the frequency distribution of survey households with respect to home community and product class appears in Table 2, which also includes information on the number of households that never purchased a particular product. For only two product classes (gas, diesel, and propane; tobacco and alcohol) were there more households usually purchasing within the home community than outside of it. Also noteworthy is the fact that almost half of the survey respondents reported never having purchased computers, toys, or games or motor homes and trailers (Table 2).

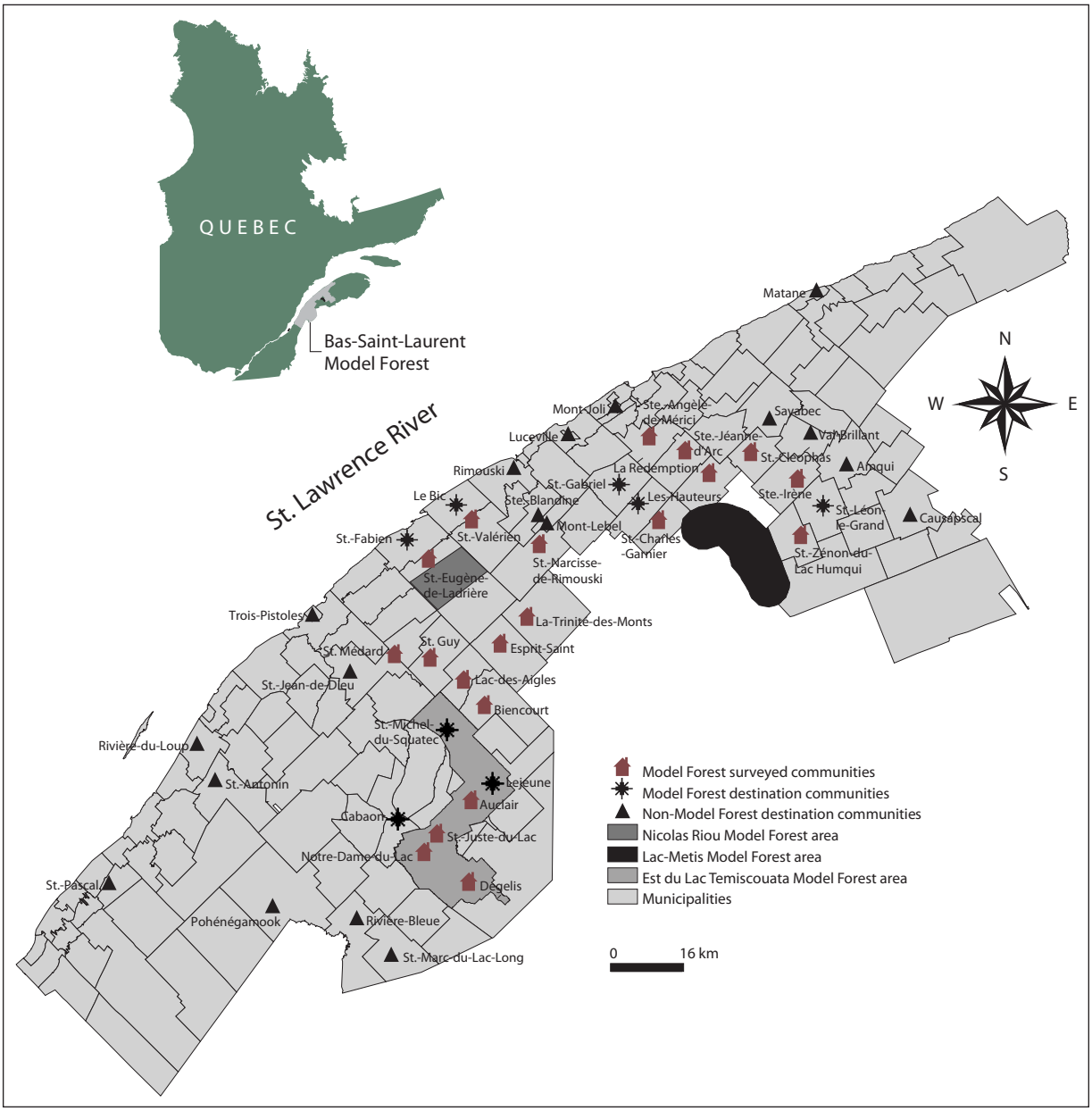

Figure 1. Bas-Saint-Laurent Model Forest areas and study-associated communities.

Table 2. Distribution of usual location of purchases for households in the Bas-Saint-Laurent Model Forest, by product class, based on the Canadian Forest Service household expenditure survey

Product class	Usual location of purchases; no. (%) of respondents stating usual location of purchases[a]				No. (%) of respondents who never made purchases[b]	
	Within home community		Outside of home community			
Food from grocery stores	208	(41.7)	291	(58.3)	0	(0.0)
Food from restaurants	153	(32.5)	318	(67.5)	28	(5.6)
Household supplies	190	(38.5)	304	(61.5)	5	(1.0)
Clothing	16	(3.2)	481	(96.8)	2	(0.4)
Gas, diesel and propane	242	(50.8)	234	(49.2)	23	(4.6)
Dental and optical products	244	(48.9)	255	(51.1)	0	(0.0)
Medicine and pharmacy products	178	(35.8)	319	(64.2)	2	(0.4)
Spectator and entertainment purchases	61	(15.3)	337	(84.7)	101	(20.2)
Computers, toys, and games	21	(7.9)	244	(92.1)	234	(46.9)
Tobacco and alcohol	201	(50.9)	194	(49.1)	104	(20.8)
Reading material	108	(24.1)	341	(75.9)	50	(10.0)
Small gifts and accessories	54	(11.1)	432	(88.9)	13	(2.6)
Furniture and appliances	113	(23.2)	374	(76.8)	12	(2.4)
Home entertainment	96	(19.8)	390	(80.2)	13	(2.6)
Sporting and recreation	61	(14.0)	374	(86.0)	64	(12.8)
Recreational vehicles	67	(17.3)	321	(82.7)	111	(22.2)
New cars and trucks	44	(10.0)	396	(90.0)	59	(11.8)
Used cars and trucks	58	(13.3)	377	(86.7)	64	(12.8)
Motor homes and trailers	9	(3.3)	263	(96.7)	227	(45.5)
Vacations	0	(0.0)	403	(100.0)	96	(19.2)

[a]In these two columns, the numbers in parentheses are percentages with respect to the total number of respondents who made purchases (499 minus value in last column of table).
[b]In this column, the numbers in parentheses are percentages with respect to the number of survey respondents (499).

Travel distance is an important variable influencing spending behavior (Yanagida et al.1991; Olfert and Stadler 1994). The individual trip information that would be necessary for a travel cost model was not available from the household expenditure survey, so travel distances were deemed a reasonable proxy of the travel costs that consumers had to bear. The general assumption is that destination communities located further away from the community of residence than other destination communities will have lower visitation because of the higher travel costs involved; however, numerous other factors, such as the population size of the destination communities relative to that of the respondent's home community and road quality, may complicate this assumption. Rimouski is the largest community in the BSLMF area (Table 1), and distances between this center and the surveyed communities varied widely. For example, Saint-Valérien was only 20 km away, whereas Dégelis was 139 km away. A geographic information system was used to determine road distances among the surveyed communities and between the surveyed communities and destination communities; these values were included in percent expenditure leakage models. Descriptive statistics about distances and other

continuous and ordinal variables used to model household expenditure leakage are shown in Table 3. The categorical variables family type, sector employment, and education are presented in Tables 4 to 6, respectively. These variables were disaggregated into dummy variables for modeling purposes because they had no quantitative meaning, i.e., they are not expressed in terms of a physical or quantifiable unit of measure. For example, education was measured by type of highest level of education achieved, rather than number of years of education completed.

Table 3. Data for surveyed and derived variables in the Canadian Forest Service household expenditure survey for the Bas-Saint-Laurent Model Forest

Survey variable	Mean	Standard deviation	Minimum	Maximum
Age class[a]	3.4	1.3	1	6
Income class[b]	3.4	1.7	1	8
No. of unemployed adults in household	0.8	0.8	0	4
Population of surveyed communities	1 375	1 204	106	3 317
Population of destination communities[c]	400 000[d]	58 366	0	800 000
Distance to destination communities (km)[e]	63.8	46.4	0	479.42
Sum of distances to destination communities (km)[f]	787.4	690.3	0	7 191.29
Per-household percent leakage for durable goods	86.3	26.6	0	100.0
Per-household percent leakage for all goods	72.1	27.4	0	100.0

[a]Respondents were asked to specify their age within one of six age classes. See Appendix 1.
[b]Respondents were asked to specify their total household income within 1 of 13 income classes (Appendix 1); the data were subsequently condensed to 8 income classes because few respondents reported incomes over $80 000.
[c]Based on the average population of all destination communities across 19 product classes.
[d]Value shown is median of population of destination communities. Mean was 32 111.
[e]Based on distance traveled across 19 product classes.
[f]Sum of the distances to all destination communities, even if more than one destination was the same across more than one product class.

Table 4. Distribution of family type in the Bas-Saint-Laurent Model Forest, based on the Canadian Forest Service household expenditure survey

Model variable names	Description of family type	No. (%) of households	
FT1	Single man or woman < 45 years	19	(3.8)
FT2	Married couple, no children	183	(36.7)
FT3	Married couple with husband < 45 years, 1 child	46	(9.2)
FT4	Married couple with husband < 45 years, 2 children	63	(12.6)
FT5	Married couple with husband < 45 years, ≥ 3 children	46	(9.2)
FT6	Lone-parent, any number of children	18	(3.6)
FT7	Three adults, no children	53	(10.6)
FT8	Three adults, any number of children	32	(6.4)
FT9	Four adults, no children	21	(4.2)
FT10	Four adults, any number of children	18	(3.6)

Table 5. Distribution of primary sector of occupation in the Bas-Saint-Laurent Model Forest, based on the Canadian Forest Service household expenditure survey

Model variable names	Employment sector	No. (%) of households	
AG	Agriculture	36	(7.2)
FOR	Forestry	107	(21.4)
CONS	Construction	19	(3.8)
FINPROF	Financial or professional services	37	(7.4)
OILGAS	Oil and gas (energy)	2	(0.4)
GOVT	Government	50	(10.0)
MINING	Mining industry	16	(3.2)
SERV	Service industry	34	(6.8)
TRAP	Transportation	30	(6.0)
TRAF	Transfers[a]	119	(23.8)
OTHER	Other sectors	49	(9.8)

[a]Canada Pension Plan benefits, social assistance payments, and investment income.

Table 6. Distribution of highest level of education achieved in the Bas-Saint-Laurent Model Forest, based on the Canadian Forest Service household expenditure survey

Model variable names	Description of education level	No. (%) of households	
ED1	Never attended school	2	(0.4)
ED2	Completed grade school	67	(13.4)
ED3	Some high school	140	(28.1)
ED4	High school graduate	114	(22.8)
ED5	Technical school	52	(10.4)
ED6	Some college or university	64	(12.8)
ED7	Undergraduate university degree	44	(8.8)
ED8	Graduate university degree	16	(3.2)

It would have been unrealistic to expect respondents to provide dollar figures for each product class over the telephone, so expenditure data were drawn instead from Statistics Canada's survey of household expenditures (Statistics Canada 1998). The direct estimates of household expenditure from the Statistics Canada survey did not concurrently incorporate three important characteristics: expenditures reflecting rural nonfarm households in Quebec (which is how households in this area of the province are classified by the Statistics Canada census), level of household income, and demographic structure. Therefore, before total household expenditures per product class could be determined for each respondent, it was necessary to account for the effect of these three elements on respondent expenditures for each product class. Ten demographic groups identified by family structure and 9 levels of household income were identified in the survey of household expenditures (Statistics Canada 1998). The following equation was used to calculate a modifier for estimating the household expenditure for product class *i*:

$$MODIFIER = \frac{(1-\frac{R^i}{QU^i})+(1-\frac{INC^i}{QU^i})+(1-\frac{DEM^i}{QU^i})}{3} \quad (1)$$

where *R* is the average expenditure of a rural Quebec household for product class *i*, *QU* is the average expenditure across all Quebec households for product class *i*, *INC* is the average expenditure on product class *i* by income category, and *DEM* is the average expenditure on product class *i* by demographic group in Quebec.

Average expenditure (*EXP*) by product class *i* and family structure *j* can be estimated with the following equation:

$$EXP_j^i = QU^i - (QU^i)(MODIFIER_j^i) \quad (2)$$

The results of the modification yielded estimated household expenditures for each of the 18 classes of household goods and services (including vacations) according to household income, family structure, and the rural nature of the economy (see Appendix 2 for an example). The modified Statistics Canada expenditure data were then twinned with data for individual participants in the BSMLF telephone survey, according to the respondent's family type and income class.

Expenditures and expenditure leakage by product class and other characteristics are shown in Table 7, whereas overall expenditure leakage data for 17 of the 18 communities in the BSLMF (excluding Saint-Guy, because no respondents from this community were included in the final survey sample) and for the whole model forest are presented in Table 8. The figures for total percent expenditure leakage in Table 7 are very similar to those in Table 2 (see "Outside of home community" column), the minor differences being attributable to proportional variation by income and family type. Households with higher incomes may spend proportionately more on vacations, for example. Table 7 also provides a breakdown of expenditure leakage outside of the home community between communities inside and outside the BSLMF. The bulk of spending outside of the home community (about 90%) occurred outside of the model forest.

In general, as absolute spending outside the community of residence increases, so too does the proportion of total spending that takes place outside the home community (the percent expenditure leakage). Spending outside of the home community for several product classes (food from grocery stores; food from restaurants; household supplies; gas, diesel, and propane; dental and optical products; medicine and pharmacy products; and tobacco and alcohol), collectively accounting for about 51% of total purchases (Table 7), increased more rapidly as percent expenditure leakage for these 7 products increased than did increases in spending as percent expenditure leakage increased in the remainder of the product classes. Percent expenditure leakage reached a plateau at a total out-of-community expenditure for all product classes of roughly $12 000, after which percent expenditure leakage varied between 84% and 100%.

Respondents spent more on food from grocery stores than on items from any other product class (24.2% of total expenditure), followed by clothing (10.6%) and new and used cars and trucks at 9.4% and 9.3%, respectively. Perhaps the most telling feature evident in Table 7 is that the percent leakage for nondurable products and services was 65.4%, similar to the percentage

Table 7. Expenditures and percent leakage by product class for the Bas-Saint-Laurent Model Forest, based on the Canadian Forest Service household expenditure survey

Product class	Total expenditure ($)	% of spending on all product classes	% leakage to model forest communities	% leakage to communities outside model forest	Total % leakage	Total leakage ($)
Nondurable goods and services						
Food from grocery stores	2 220 601	24.2	3.4	55.2	58.6	1 302 213
Food from restaurants	478 985	5.2	6.0	61.8	67.8	324 737
Household supplies	510 980	5.6	6.1	55.6	61.7	315 702
Clothing	976 316	10.6	1.6	95.4	97.0	946 969
Gas, diesel, and propane	667 695	7.3	7.3	42.2	49.5	330 561
Dental and optical products	177 134	1.9	4.9	46.5	51.3	90 890
Medicine and pharmacy products	184 045	2.0	12.0	52.2	64.2	118 201
Spectator and entertainment	64 838	0.7	5.5	80.2	85.7	55 554
Computers, toys, and games	72 669	0.8	7.7	84.3	92.0	66 881
Tobacco and alcohol	451 961	4.9	7.3	42.2	49.5	223 788
Reading material	112 300	1.2	3.1	73.3	76.4	85 838
Small gifts and accessories	41 373	0.4	1.2	88.2	89.4	37 004
Subtotal, nondurables	5 958 897	64.8	4.6	60.8	65.4	3 898 338
Durable goods and services						
Furniture and appliances	581 657	6.3	10.0	67.0	77.0	447 617
Home entertainment	217 563	2.4	9.0	71.7	80.8	175 723
Sporting and recreation	154 866	1.7	4.0	82.6	86.6	134 061
Recreational vehicles[a]	188 700	2.1	7.9	74.5	82.4	155 474
New cars and trucks[b]	866 237	9.4	18.7	71.4	90.1	780 683
Used cars and trucks	849 067	9.3	17.8	68.5	86.3	732 860
Motor homes and trailers	131 503	1.4	6.4	90.5	96.9	127 472
Vacations	236 814	2.6	3.2[c]	96.8	100.0	236 814
Subtotal, durables[d]						
Overall total, all product classes	3 226 407	35.2	13.2	73.3	86.5	2 790 704
Totals for all product classes	9 185 304	100.0	7.7	65.1	72.8	6 689 042

[a]Items such as all-terrain vehicles, boats, snowmobiles, and dirt bikes. A single expenditure figure from Statistics Canada was applied to both the survey's recreational vehicles category and its motor homes and trailers category for the purposes of modeling percent leakage. The difference between expenditures for the survey's recreational vehicles category and its motor homes and trailers category is attributable to respondents who never purchased one or the other product.
[b]Statistics Canada groups new and used cars and trucks into one category. The Statistics Canada expenditure figure was applied to both the survey's new and used cars and trucks categories for the purposes of modeling percent leakage. The difference between total expenditures for the new cars and trucks category and the used cars and trucks category is attributable to respondents who never purchased one or the other product.
[c]Some expenditure associated with this percentage may have been made within the home community. There was no specific response category in the survey for at-home vacations, on the assumption that most respondents would spend a vacation outside of their home community. All spending was therefore assumed to have occurred in other communities in the Bas Saint-Laurent Model Forest.
[d]Vacations are considered durable goods because their infrequent occurrence and relatively high cost are more akin to the characteristics of durable goods than of nondurable goods and services.

Table 8. Percent household expenditure leackage by community for the Bas-Saint-Laurent Model Forest, based on the Canadian Forest Service household expenditure survey

Community	% leakage	Community	% leakage
Auclair	60.9	Saint-Cléophas	100.0
Biencourt	65.3	Saint-Eugène-de-Ladrière	94.0
Dégelis	47.5	Saint-Irène	97.1
Esprit-Saint	96.2	Saint-Juste-du-Lac	92.7
La Rédemption	93.1	Saint-Médard	63.7
La Trinité-des-Monts	89.8	Saint-Narcisse-de-Rimouski	95.7
Lac-des-Aigles	74.0	Saint-Valérien	90.1
Notre-Dame-du-Lac	50.0	Saint-Zénon-du-Lac-Humqui	74.1
Saint-Charles-Garnier	95.7	Bas-Saint-Laurent Model Forest	72.8

of total spending on these products (64.8%). In contrast, 86.5% of spending on durable products occurred outside the community of residence. This suggests that overall percent expenditure leakage was strongly influenced by spending on durable products. Percent leakage for clothing (97.0%) was higher than for any other product class, except vacations, for which all spending was assumed to occur outside the community of residence. Percent leakage was slightly lower (96.9%) for motor homes and trailers and was 92.0% for computers, toys, and games. Purchases made over the Internet amounted to 0.6% of total expenditures made outside of the home community.

Percentage expenditure leakage by community varied between 47% and 100% (Table 8), with leakage closely tied to the community's population. The larger communities of Dégelis and Notre-Dame-du-Lac exhibited the lowest percent leakage values (47.5% and 50.0%, respectively), whereas the smaller communities of Saint-Cléophas and Sainte-Irène exhibited the highest percent leakages (100.0% and 97.1%, respectively).

The most frequently visited destination community was Rimouski, followed by Rivière-du-Loup, Edmundston, Cabano, Amqui, and Dégelis. Survey respondents traveled on average to three destination communities to meet their consumer needs, purchasing items from an average of 12 and a maximum of 19 product classes in the destination communities. Some respondents visited no destination communities for their consumer purchases, whereas others traveled to as many as 11 destination communities to satisfy their consumer needs.

The household expenditure survey also posed questions about the reasons for decisions about where to purchase nondurable and durable goods. For both nondurable goods and services and durable goods, location was cited as the dominant reason by the largest proportion of respondents (39.7% and 36.1%, respectively) (Table 9). This probably reflects the inconvenience and cost involved in traveling to another community to make similar purchases. Also, 21.2% of the respondents indicated that they made local purchases of nondurable goods and services to support local businesses. Support for local businesses was only 12.2% for purchases of durable goods, such as automobiles and furniture, reflecting the greater percent leakage for this category of purchases relative to nondurable goods. Price was the second most prominent reason for choice of where to buy durable goods, likely reflecting the higher cost of durables in relation to nondurables. For both nondurable goods and services, price was the third most important reason, after location and support for local businesses.

Table 9. Main reasons for decisions about where to purchase goods and services

	% of respondents	
Reason for purchase	Nondurable goods	Durable goods
Price	17.2	20.2
Location	39.7	36.1
Selection	16.4	19.2
Support local businesses	21.2	12.2
Other	5.4	12.2

ANSWERING THE RESEARCH QUESTIONS: LEAKAGE MODELING AND DEPENDENCE INDICES

Leakage Modeling

Methods

The general form of the relationship between percent expenditure leakage and the explanatory variables examined in the survey is described below. The independent variables in the household expenditure survey for model forests were a mixture of ordinal, categorical, and continuous variables, whereas the dependent variable (experc, percent leakage for all goods) was continuous, ranging between 0% and 100% (Table 3). A percent leakage value near 100% indicates that the majority of household expenditures are made outside the home community. The following independent variables were expected to influence percent leakage: "age," the age of the respondent, "edu," the respondent's highest level of education; "income," the total household income; "famtype," 1 of 10 family types from the Statistics Canada survey of household expenditures (Statistics Canada 1998); "unemp," the number of unemployed adults in the household; "hpop," the population of a respondent's home community; "occup," the sector of occupation providing the majority of the household's income; "dpop," the population of destination communities; and "distance," the distance between the respondent's home community and the various destination communities.

$$\text{experc} = \beta_0 + \beta_1\text{edu} + \beta_2\text{age} + \beta_3\text{income} + \beta_4\text{famtype} + \beta_5\text{unemp} + \beta_6\,\text{hpop} + \beta_7\text{occup} + \beta_8\text{dpop} + \beta_9\text{distance} + \varepsilon \quad (3)$$

where

ß = estimated parameters or coefficients, and

ε = the model's stochastic or random component.

Results and Discussion

The descriptions of basic and derived variables used in the model of percent household expenditure leakage for all goods and services are reported in Table 10. The results of the ordinary least squares regression model for percent expenditure leakage are shown in Table 11. The independent variables listed in Table 11 have been scaled, as described in Table 10, so that the model's estimated coefficients are the same order of magnitude. Because leakage spending outside of the model forest far exceeded leakage spending in other model forest communities, and the explanatory variables would therefore be generally more applicable to spending outside of the region, the model was applied to total percent leakage (experc) only.

The two distance variables (DISTKM, which is the sum of all distances traveled to make purchases across the product classes, and DISTKM2, which is the square of the DISTKM variable) were significant in explaining percent expenditure leakage. This is not surprising, given the need to travel greater distances to purchase household goods and services and consumers' awareness of the high travel costs associated with purchases made in distant locations. As such, distance was expected to dampen percent household leakage, as indicated by the negative sign of the DISTKM2 variable. The marginal effect of the DISTKM and DISTKM2 variables on the dependent variable was to decrease the rate of increase in percent expenditure leakage. Although an increase in travel distance dampened percent expenditure leakage in this study, the reverse may be true elsewhere in Canada, where only a limited number of rather distant destination communities are reasonably available; in that situation, residents might travel to the most distant but largest destination community because its choice of price and selection options outweighs the higher travel costs.

Table 10. Descriptions of basic and derived variables used in the model of percent household expenditure leakage for all goods and services

Variable name and units	Variable description	Mean	Standard deviation
DISTKM (km)	Sum of distances/1000[a]	0.787	0.691
DISTKM2	Square of DISTKM/10	2.58[b]	0.363
AVDIST (km)	Average of expenditure-weighted distances/100[a]	0.620	0.451
AVDIST2	Square of AVDIST	7.85[c]	1.30
HPOP	Population of home community/100	13.75	12.05
HPOP2	Square of HPOP/100	5.50[d]	4.45
INCOME	Total household income	3.42	1.69
SPENDPOP ($)	Average of nonlocal spending weighted by population of destination communities/1000[e]	0.934	0.326
SPENDPOP2	Square of SPENDPOP	0.979	0.709
ED2–ED8	Dummy variables for education levels 2 to 8	NA[f]	NA
FT2–FT10	Dummy variables for family types 2 to 10	NA	NA
EDL	Cluster dummy variable for Est du Lac Témiscouata model forest area	NA	NA
NR	Cluster dummy variable for Nicolas Riou model forest area	NA	NA

[a]Distances include duplicate distances.
[b]Median value; mean was 0.11.
[c]Median value; mean was 0.59.
[d]Median value; mean was 3.34.
[e]Communities include duplicate communities.
[f]NA = not applicable.

Table 11. Results of ordinary least squares regression model of percent household expenditure leakage for all goods and services[a]

Variable name[b]	Estimated coefficient	Standard error	*t* ratio (df = 471)	*p* value
DISTKM	64.600	3.016	21.420	<0.001
DISTKM2	−67.341	5.537	−12.160	<0.001
AVDIST	−72.898	5.528	−13.190	<0.001
AVDIST2	12.072	1.873	6.445	<0.001
HPOP	−1.329	0.304	−4.369	<0.001
HPOP2	2.560	0.781	3.329	0.001
INCOME	−1.809	0.392	−4.616	<0.001
SPENDPOP	63.063	9.073	6.951	<0.001
SPENDPOP2	−14.784	3.936	−3.756	<0.001
ED2	−18.167	6.166	−2.946	0.003
ED3	−22.900	6.052	−3.784	<0.001
ED4	−19.482	6.007	−3.243	0.001
ED5	−21.856	6.154	−3.552	<0.001
ED6	−23.258	6.134	−3.792	<0.001
ED7	−24.644	6.158	−4.002	<0.001
ED8	−26.215	6.636	−3.950	<0.001
FT2	−6.355	3.154	−2.015	0.044
FT3	−3.849	2.486	−1.548	0.122
FT4	−6.011	2.629	−2.286	0.023
FT5	−3.249	2.847	−1.141	0.254
FT6	−2.171	3.393	−0.640	0.523
FT7	−6.962	3.628	−1.919	0.056
FT8	−5.898	2.818	−2.093	0.037
FT9	−4.506	3.480	−1.295	0.196
FT10	11.165	4.521	2.469	0.014
EDL	−9.423	2.158	−4.366	<0.001
NR	4.818	1.623	2.968	0.003
CONSTANT	69.160	8.575	8.065	<0.001

[a]R^2 (adjusted) = 0.81. Log-likelihood = −1 933.63.
[b]Variables described in Table 10.

The AVDIST variable was the average of all distances weighted by expenditures. AVDIST and its square, AVDIST2, had an interesting effect on percent expenditure leakage, with the destination communities where respondents made the greatest expenditures, such as Rimouski, influencing this variable. In fact, Rimouski accounted for 38% of all household expenditures made outside of the home community, and the top three destination communities (Rimouski, Rivière-du-Loup, and Edmundston) accounted for over 53% of all expenditures made outside of the home community. The AVDIST and AVDIST2 variables had the same effect on percent expenditure leakage as the DISTKM and DISTKM2 variables when used by themselves in the model. However, they worked in concert with the DISTKM and DISTKM2 variables (with opposite signs) to greatly increase the model's ability to explain the variation in the dependent variable (experc). The combined use of these two sets of distance variables resulted in a better model than those that resulted from using either set on its own. This suggests that the effect of distance on percent expenditure leakage was driven in part by where most expenditures were made, but this effect was modulated by the distances traveled to all destination communities to make purchases across all of the product classes.

The distances used in the regression model included the use of duplicate distances, which would occur when two or more product classes were usually purchased in the same destination community. Duplicate distances for different product classes were common among respondents to the household expenditure survey. In contrast, using nonduplicate distances would mean using only one distance per combination of home and destination community. The total and average nonduplicate distances to destination communities were, interestingly, insignificant in the ordinary least squares regression model, which suggested that DISTKM, itself a sort of weighted distance, may reflect the multitrip nature of purchase behavior.

The effect on the model of the two variables for the population of the home community, HPOP and HPOP2 (the square of HPOP), confirmed the hypothesis that larger home communities would have lower percent household leakage. This finding is logical because larger communities can be expected to offer a greater range of goods and services than smaller communities. The positive sign for the HPOP2 coefficient (Table 11) indicates that the rate of decrease in percent expenditure leakage increased as the population of the home community increased. The sum of the populations of destination communities (including duplicate communities) was a significant indicator of the greater purchase opportunities available in larger centers in earlier models, but it was insignificant in the final model.

It was expected that percent expenditure leakage would increase with income, because higher incomes would permit greater spending on travel. However, the coefficient for income, although significant, had an effect contrary to expectations, its negative sign indicating that percent expenditure leakage decreased with increasing income (Table 11). It thus appears that the opportunity cost of traveling was quite high. Respondents would rather spend their time doing something other than traveling to destination communities to satisfy their consumer needs, assuming that prices for goods and services were higher in the home community than in destination communities, most of which lie outside of the model forest region. Yanagida et al. (1991) also found that income was negatively correlated with leakage (i.e., higher income contributed to lower expenditure leakage).

The variable SPENDPOP, the mean weighted per-product spending outside of the community of residence, is the product of spending outside the home community and the population of the destination communities, weighted by the total population of duplicate and nonduplicate destination communities. The effects of this interaction variable and its square (SPENDPOP2) in the final model (Table 11) accentuated the observation that greater spending generally occurred in destination communities with commensurately higher populations. This result is not surprising, given that larger centers generally offer a greater number and variety of outlets for goods and services, particularly for durable goods.

Level of educational attainment has long been recognized as an indicator of well-being through its effect on income and other aspects of quality of life. All of the seven levels of attained education that were incorporated as dummy variables, relative to the category "never attended school" (Table 6), were significant regressors in the final model (Table 11). The increasing magnitude of the estimated coefficients from the lowest to the highest level of education attained suggested that percent expenditure leakage declined with greater educational attainment.

Family type (Table 4) was included as an independent variable in this study because Statistics Canada's survey of household expenditures (Statistics Canada 1998) clearly showed that household expenditures vary considerably across family types (other things being equal). Although not all of the individual family types were significant, family type was collectively strongly significant in explaining the variation in percent expenditure leakage. The FT10 family type (four adults with any number of children) was the only family type with a positive coefficient. Perhaps some members of large families had more time or resources than members of smaller families to shop outside of the home community. All family-type dummy variables in the model were estimated in relation to the FT1 family type (a single man or woman under 45 years of age).

Interestingly, no occupational groups were significant in explaining percent expenditure leakage, which suggested that occupation had little or no influence on expenditure leakage,

except through income. It was hypothesized that some occupations might have been associated with higher leakage than others because they afforded opportunities to make purchases for the household while working away from the home community. An additional hypothesis that the number of unemployed adults in a family would be a significant regressor was based on the assumption that unemployed family members would have sufficient time on their hands to shop outside the home community for bargains on consumer goods and services. However, this hypothesis was rejected on the basis of the regression results. This phenomenon is discussed further in the "Results and Discussion" portion of the section on dependence indices, below.

Other regressors shown in Table 11 that were significant in explaining percent expenditure leakage were dummy variables indicating which of three clusters of communities associated with the model forest areas was the respondent's place of residence (Fig. 1). The three clusters were the communities of Auclair, Biencourt, Dégelis, Lac-des-Aigles, Notre-Dame-du-Lac, Saint-Guy, Saint-Juste-du-Lac, and Saint-Médard for the Est du Lac Témiscouata model forest area; Esprit-Saint, La Trinité-des-Monts, Saint-Eugène-de-Ladrière, Saint-Narcisse-de-Rimouski, and Saint-Valérien for the Nicolas-Riou model forest area; and La Rédemption, Saint-Charles-Garnier, Saint-Cléophas, Sainte-Irène and Saint-Zénon-du-Lac-Humqui for the Lac-Metis model forest area. Residents of a community in the Est du Lac Témiscouata model forest area were predicted to have household expenditure leakage 9% lower than that of residents of the Lac-Metis model forest area, whereas residents of the Nicolas Riou model forest area were predicted to have expenditure leakage 5% higher than that of residents of the Lac-Metis model forest area. The actual expenditure leakage from each cluster was 56% from the Est du Lac Témiscouata cluster of communities, 93% from the Nicolas Riou cluster, and 92% from the Lac-Metis cluster. The location of each of the clusters with respect to major urban communities and the average population of the communities making up each cluster may each play a role in this outcome. Communities in the Nicolas Riou cluster are relatively close to Rimouski, which would make trips for consumer purchases less costly than trips from communities in the other clusters. The average population of a community in the Est du Lac Témiscouata cluster was 1 039 people, whereas it was 399 people in the Lac-Metis cluster. The use of the cluster dummy variables resulted in a much better model than would have been the case had the population of destination communities been used as a regressor.

As noted earlier, percent expenditure leakage was higher for durable goods than for nondurable goods and services. Initial models for expenditure leakage for all products indicated that the percent expenditure leakage for durable goods was a significant driver of overall percent expenditure leakage. A model with percent expenditure leakage for durable goods relative to total expenditure on all durable goods as the dependent variable was therefore investigated to determine any differences between this model and the overall model (Tables 12 and 13).

The results of this model were generally similar to those of the all-products or overall model, but there were differences for a few of the variables. Two dummy variables for occupational groups, MINING (for mining) and TRAP (for transportation), were significant in the model for durable goods (Table 13) but not in the overall model. The positive signs of the MINING and TRAP coefficients may reflect the greater opportunities that people employed in these sectors have to make purchases for the home while they are working away from home.

The populations of destination communities were not significant in any of the models for durable goods that preceded the final model, but this variable was significant in some of the earlier versions of the all-products model. This pattern may have occurred because a greater proportion of durable goods were purchased in communities outside of the BSLMF (73.3% of expenditures on durable goods but only 60.8% of expenditures on nondurable goods and services were made outside the model forest). Most of the communities outside the BSLMF may have population sizes above the threshold at which a community has an adequate selection of durable goods available for purchase. The average population of surveyed and destination communities within the BSLMF was 1 061 people, whereas the average population of destination communities outside of the model forest (other than Montréal) was 16 100 people. This

substantial difference in average populations may also explain, to some extent, why the percent expenditure leakage for all products to BSLMF communities was only 7.7%, whereas the percent leakage to communities outside the model forest was 65.1% (Table 7). The variables for both the Est du Lac Témiscouata and Nicolas Riou clusters were significant in the model for durable goods, as well as in the all-products model; however, the variable for the Est du Lac Témiscouata cluster had a positive sign in the model for durable goods but a negative sign in the all-products model. It is also noteworthy that family types and levels of education achieved were individually and collectively insignificant in the model for durable goods, whereas they were individually and collectively significant in the all-products model. Family type and education clearly had a greater influence on the purchase of nondurable goods and services than on the purchase of durable goods, which may reflect a general lack of selection or availability of durable goods in the home community. Residents may simply have no choice but to purchase most durable goods outside of the home community, as indicated by the greater leakage of expenditures for durable goods relative to nondurable goods and services (Table 7).

Table 12. Descriptions of basic and derived variables used in the model of percent household expenditure leakage for durable goods[a]

Variable name and units	Variable description	Mean	Standard deviation
DISTKM (km)	Sum of all distances/1000[b]	0.348	0.380
DISTKM2	Square of DISTKM/10	2.60[c]	0.36
AVDIST (km)	Average of expenditure-weighted distances/100[b]	2.94[d]	0.67
AVDIST2	Square of AVDIST/10	1.72[e]	0.32
SPENDPOP ($)	Average of nonlocal spending, weighted by population of duplicate and nonduplicate destination communities/1000[f]	0.944	0.390
SPENDPOP2	Square of SPENDPOP	1.045	0.887
AG	Dummy variable for agriculture sector	NA[g]	NA
FOREST	Dummy variable for forestry sector	NA	NA
CONS	Dummy variable for construction sector	NA	NA
FINPROF	Dummy variable for financial and professional services sector	NA	NA
OILGAS	Dummy variable for oil and gas (energy) sector	NA	NA
GOVT	Dummy variable for government sector	NA	NA
MINING	Dummy variable for mining sector	NA	NA
SERV	Dummy variable for service sector	NA	NA
TRAP	Dummy variable for transportation sector	NA	NA
TRAF	Dummy variable for transfers sector	NA	NA

[a]Variables that have the same names and the same means and standard deviations as the variables shown in Table 10 are not presented in this table
[b]Distances include duplicate distances.
[c]Median value; mean was 0.11.
[d]Median value; mean was 0.66.
[e]Median value; mean was 0.088.
[f]Communities include duplicate communities.
[g]NA = not applicable.

Table 13. Results of ordinary least squares regression model of percent household expenditure leakage for durable goods[a]

Variable name[b]	Estimated coefficient	Standard error	*t*-ratio (df = 477)	*p*-value
DISTKM	71.909	7.336	9.8030	<0.001
DISTKM2	−137.250	30.740	−4.465	<0.001
AVDIST	−28.000	4.924	−5.686	<0.001
AVDIST2	23.502	11.134	2.072	0.039
HPOP	−3.176	0.374	−8.480	<0.001
HPOP2	6.841	0.967	7.077	<0.001
INCOME	−1.340	0.451	−2.970	0.003
SPENDPOP	94.920	5.494	17.280	<0.001
SPENDPOP2	−30.467	2.358	−12.920	<0.001
AG	2.445	3.132	0.781	0.435
FOREST	0.732	2.482	0.295	0.768
CONS	6.220	3.874	1.607	0.109
FINPROF	3.747	3.133	1.196	0.232
OILGAS	−1.696	10.290	−0.165	0.869
GOVT	−2.467	2.904	−0.849	0.396
MINING	8.727	4.118	2.119	0.035
SERV	0.719	3.218	0.223	0.823
TRAP	6.988	3.304	2.115	0.035
TRAF	2.827	2.475	1.142	0.254
EDL	3.971	2.173	1.828	0.068
NR	6.781	2.013	3.369	0.001
CONSTANT	41.615	4.525	9.197	<0.001

[a]R^2 (adjusted) = 0.72. Log-likelihood = −2 018.36.
[b]Most variables described in Table 12.

Dependence Indices

Methods

A community's dependence on a particular sector is commonly measured by allocation of employment or income. However, in this study, it has been argued that the location and amount of consumer household expenditures represent other measures of a community's dependence on a particular sector. Analysis of household expenditures has been ignored in the community dependence literature because it requires detailed information about the geographic location of expenditures and about the amount of expenditure occurring within and outside the region of interest. Such analysis is both time-consuming and expensive; however, data from the Canadian Forest Service household expenditure survey allowed this type of analysis for the BSLMF region.

Household expenditure analysis provides detailed information about spending leakages from a local or regional economy. It has the potential to account for the effects of increased or decreased investment in particular sectors of the economy (Davis and Hutton 1992). As the models of percent leakage expenditure described above have shown, a portion of the income earned within a regional economy will leak from that economy in the form of expenditures on goods and services, with the magnitude of the leakage being affected by a number of characteristics, including income and distances to surrounding communities.

The method used in this study to calculate the dependence indices based on measurements of employment, income, and household expenditures is founded on the work of Fletcher et al. (1991) and Korber et al. (1998). More specifically, the location quotient method was

employed to estimate the economic base for various sectors of the economy. The current study used the method of Korber et al. (1998) for calculating location quotients. The location quotient (LQ) of community *j* for industry *i* was calculated as follows:

$$LQ_j^i = \frac{(E_j^i / E_j^T)}{(E_p^i / E_p^T)} \quad (4)$$

where *E* is employment, *T* is all sectors, and *P* is the entire province.

Equation 4 assumes no net exports or imports and no inventories. If the province is a net exporter, location quotients overestimate the level of employment necessary to provide for local consumption at the community level and consequently underestimates the level of community base employment. Conversely, if the province is a net importer, the level of community base employment will be overestimated (Schwartz 1982; Korber et al. 1998). Therefore, provincial benchmarks used in the calculation of location quotients had to be adjusted to reflect only the output required to meet local or regional consumption. The adjusted benchmark employment for use in the equation for a location quotient is as follows:

$$E_P^i * = [(T_n^i - R_n^i + M_n^i) / T_n^i] E_P^i \quad (5)$$

where T_n^i is the total provincial output from industry *i,* R_n^i is the provincial export from industry *i,* M_n^i is the provincial import from industry *i,* E_P^i is the provincial employment in industry *i*, and * denotes variables of special or changed significance. The equation for a location quotient can be rewritten, with the modifications presented above, as follows:

$$LQ_j^i = \frac{(E_j^i / E_j^T)}{(E_P^i * / E_P^T)} \quad (6)$$

Base employment is considered to be employment in a given sector above the provincial average. The provincial average (that is, the average across all CSDs in the province) is assumed to be the sector employment required to serve local needs in the community. The proportion of sector employment that is estimated to be basic is calculated as follows:

$$X_j^i = \frac{(LQ_j^i - 1)}{LQ_j^i} E_j^i \quad (7)$$

Fletcher et al. (1991) and Korber et al. (1998) used equations 5 through 7 to estimate a forest dependence index using census data. The most recent economic base data relevant to the BSLMF can be obtained from the analysis of major sectors of employment by Korber et al. (1998).

Table 14 provides employment and calculated base employment by economic sector for the communities in the BSLMF region. The source of the raw employment data was the 1996 Canada Census. The values for provincial output, import, and export variables that were used to adjust provincial employment benchmarks (equation 4) were from Statistics Canada's 1996 input–output tables. For example, a total of 1 445 people were employed in the service industry, of whom only 173 accounted for base employment. Therefore, 1 272 of the service jobs served local needs. In contrast, there were 1 195 jobs in the forestry sector, and nearly all of them (1 114) were counted as base employment, which means that the forestry sector produced outputs primarily for the export market.

From these calculations, an employment-based sector dependence index can be derived, where X_j^i is base employment in sector *i* for community *j* and ΣX_j^i is the total base employment in community *j.* The employment-based sector dependence index (ESDI) was calculated as follows:

$$ESDI = \frac{X_j^i}{\sum_{i=1} X_j^i} \quad (8)$$

Income-based sector dependence indices were estimated from average, and not total, household income per sector to facilitate their comparison with expenditure-based sector dependence indices, which are determined from population samples. The income-based sector dependence index for each community and sector was determined by dividing the product of average base income and base employment for

Table 14. Raw and basic employment, by sector and community, in the Bas-Saint-Laurent Model Forest

Community	Agriculture	Construction	Forestry	Professional and financial services	Oil and gas (energy)	Government	Mining	Service	Transportation	Transfers	Other	Total
Raw employment												
Auclair	60	20	35	10	0	45	0	90	10	115	0	385
Biencourt	20	25	90	15	0	25	0	70	15	135	0	395
Dégelis	140	15	285	35	10	250	0	455	80	885	55	2 210
Esprit-Saint	0	0	75	0	0	15	0	55	20	120	0	285
Lac-des-Aigles	20	10	55	10	0	30	10	85	45	215	10	490
La Rédemption	20	20	55	0	0	25	15	30	0	240	0	405
La Trinité-des-Monts	20	0	35	0	0	20	0	20	0	55	0	150
Notre-Dame-du-Lac	65	60	105	70	0	295	0	280	45	505	45	1 470
Saint-Charles-Garnier	30	0	30	0	0	0	0	0	0	115	0	175
Saint-Cléophas	10	10	50	0	0	20	0	40	0	150	0	280
Saint-Eugène-de-Ladrière	20	35	50	25	0	0	0	35	0	135	20	320
Saint-Guy	0	0	0	0	0	0	0	0	0	0	0	0
Sainte-Irène	20	0	25	0	0	15	0	30	0	70	0	160
Saint-Juste-du-Lac	35	0	80	0	0	30	0	20	10	270	10	455
Saint-Médard	0	0	30	10	0	0	0	20	0	120	0	180
Saint-Narcisse-de-Rimouski	55	0	90	20	0	50	10	115	40	235	20	635
Saint-Valérien	25	55	40	20	0	60	20	75	45	150	10	500
Saint-Zénon-du-Lac-Humqui	20	0	65	0	0	35	0	25	10	160	0	315
Total	560	250	1 195	215	10	915	55	1 445	320	3 675	170	8 810

Table 14. Concluded

Community	Agriculture	Construction	Forestry	Professional and financial services	Oil and gas (energy)	Government	Mining	Service	Transportation	Transfers	Other	Total
Base employment												
Auclair	48	8	32	0	0	8	0	23	0	0	0	119
Biencourt	14	12	87	0	0	0	0	12	0	7	0	132
Dégelis	73	0	262	0	0	0	0	77	0	166	3	581
Esprit-Saint	0	0	72	0	0	0	0	10	8	27	0	117
Lac-des-Aigles	5	0	51	0	0	0	8	2	25	56	6	153
La Rédemption	14	7	52	0	0	0	14	0	0	107	0	194
La Trinité-des-Monts	18	0	34	0	0	4	0	0	0	6	0	62
Notre-Dame-du-Lac	22	13	88	0	0	84	0	8	0	29	0	244
Saint-Charles-Garnier	25	0	28	0	0	0	0	0	0	60	0	113
Saint-Cléophas	6	1	47	0	0	0	0	3	0	61	0	118
Saint-Eugène-de-Ladrière	15	25	48	1	0	0	0	3	0	33	0	125
Saint-Guy	0	0	0	0	0	0	0	0	0	0	0	0
Sainte-Irène	18	0	24	0	0	8	0	15	0	18	0	83
Saint-Juste-du-Lac	28	0	76	0	0	0	0	0	0	121	0	225
Saint-Médard	0	0	29	0	0	0	0	6	0	62	0	97
Saint-Narcisse-de-Rimouski	45	0	84	0	0	0	8	5	14	29	0	185
Saint-Valérien	17	39	38	0	0	2	18	9	24	0	0	147
Saint-Zénon-du-Lac-Humqui	15	0	62	0	0	0	0	0	0	58	0	135
Total	363	105	1 114	1	0	106	48	173	71	840	9	2 830

sector *i* in community *j* by the product of average base income and base employment for all base workers. The income-based sector dependence index (ISDI) by community was calculated as follows:

$$ISDI = \frac{(AI_j^i)(X_j^i)}{\sum_{i=1} AI_j^i X_j^i} \quad (9)$$

The approach used for the employment- and income-based sector dependence indices can also be used to develop a sector dependence index based on local household expenditure data (LESDI), calculated as follows:

$$LESDI = \frac{(AE_j^i)(X_j^i)}{\sum_{i=1} AE_j^i X_j^i} \quad (10)$$

where AE_j^i is the average local annual expenditure per household for sector *i* in community *j.* Equation 10 indirectly accounts for expenditure leakage by using expenditures made in the community of residence (local expenditure) rather than total household expenditures.

All of the sector dependence indices are interpreted in the same manner: the level of dependence decreases as the index approaches 0 and increases as it approaches 1. If a sector has an index value of 1, the community or region has 100% dependence on that particular sector. Expenditure-based indices will be greater than employment-based indices for sectors in which employees spend an above-average proportion of their income within their own community. Conversely, local expenditure-based indices will be lower than employment-based indices for sectors in which employees spend a below-average proportion of their income within their own community. Sectors with above-average income will have higher values for the income-based sector dependence indices, and possibly higher values for the local expenditure-based sector dependence indices, than those based on employment data because the income and expenditure indices are weighted by incomes and expenditures, respectively. The income- and expenditure-based sector dependence indices provide ordinal rankings of income and expenditures with respect to averages established by the employment-based sector dependence index. Expenditure-based measures alter the employment- or income-based measure of community dependence and may provide a more accurate picture of sectoral contributions to the local economies of the BSLMF with respect to expenditures.

Results and Discussion

The sector dependence indices for the communities within the BSLMF are shown in Table 15 (the community of Saint-Cléophas is not included because no local expenditures were made by survey respondents). For example, the base employment sector dependence index of 0.105 for agriculture in Biencourt (column 2) means that 10.5% of Biencourt's base employment was in the agriculture sector. The income-based sector dependence index of 0.012 (column 3) means that 1.2% of the income received by employees across all sectors making up Biencourt's economic base came from the agriculture sector. Because 1.20% is less than 10.5%, it can be concluded that income from the agriculture sector was less than the average income in Biencourt. The community of Biencourt therefore seems to be less dependent on the agriculture sector than the base employment index would suggest. The providers of consumer goods and services within the community must therefore rely on other economic sectors if they are to generate an income around the community average, assuming that the average income would be the minimum required to persuade providers of consumer goods and services to remain or invest in the community. However, the expenditure-based sector dependence index of 0.142 (last column of Table 15) indicates that 14.2% of total local expenditures on household goods and services made by employees of Biencourt's economic base industries came from the agriculture sector. Because 14.2% is greater than both 10.5% and 1.20%, it can be concluded that an above-average proportion of agricultural income was spent within Biencourt. This also means that Biencourt was more dependent on the agriculture sector than the employment- and income-based sector dependence indices indicate, because of low expenditure leakage from the community for purchases made by residents working in the agriculture sector. The agriculture sector displayed this characteristic for more communities than any other sector

(Table 16). If the values for the employment- and income-based sector dependence indices were reversed, it could be concluded that income in the agriculture sector was greater than average income in Biencourt; however, because the expenditure-based sector dependence index is still greater than either of these indices, it would still be concluded that a below-average proportion of income was spent outside of Biencourt. The government sector in Notre-Dame-du-Lac is an example of this pattern (Table 15).

The employment-based sector dependence index for forestry in Saint-Valérien exhibited a different pattern. Although forestry accounted for 25.5% of base employment in this community's economic base, the higher value for the income-based index (0.275 or 27.5%) suggests that income in the forestry sector was higher than average income. However, the expenditure index (0.130 or 13.0%) was lower than both of the other indices, which suggests that Saint-Valérien was less dependent on the forestry sector than indicated by the employment- and income-based methods, because of significant expenditure leakage from the community through expenditures by employees in the forestry sector. In other words, a below-average proportion of forestry income was spent within Saint-Valérien. This type of ordinal ranking, with the local expenditure-based index the lowest of the three sector dependence indices, accounted for 35% of all combinations (Table 16). As such, a high proportion of communities in the BSLMF were less dependent on their various economic sectors than is indicated by the employment and income methods because of high expenditure leakage. However, the agriculture, forestry, and transfers sectors, the latter of which consists of Canada Pension Plan benefits, social assistance payments, and investment income, contributed heavily to this observation. These sectors had the highest concentration of expenditure-based sector dependence index values that were lower than those for the employment-based and income-based sector dependence indices (Table 16). The inclusion in the transfers sector of many retired and semiretired individuals, who may have more time to shop than people in other sectors, may be an important factor influencing high expenditure leakage in this sector. The high leakage for the agriculture and forestry sectors is more difficult to explain. Perhaps household purchases were frequently combined with travel to work in private woodlots, a predominant form of forestland tenure in the model forest. This proclivity to purchase household goods and services outside of the home community may be attributable to finer subsets of product classes than were examined in this work, as exemplified by previous research. For example, Pinkerton et al. (1995) observed that households with job-holders working outside of the local area were more likely to shop outside of the community for certain goods and services; in addition, Cowell and Green (1994) noted that purchases of subsets of the complete range of products and services were differentially influenced by the same socioeconomic variables such as income and education level. Cowell and Green (1994) also investigated the importance of place, in terms of community attachment, in explaining the location of household spending.

The expenditure index for the construction sector in Auclair (Table 15) provides another interpretation of the sector dependence indices. For that sector, the expenditure-based index (0.061 or 6.1%) fell between the corresponding employment- and income-based indices (0.064 [6.4%] and 0.033 [3.3%], respectively). An income index lower than the corresponding employment index suggests that a below-average proportion of construction income was spent within Auclair; however, the expenditure-based index indicates that Auclair was less dependent on the construction sector than the employment-based index suggests but more dependent than the income-based index indicates. This can be interpreted to mean that the proportion of construction income spent locally was about average with respect to other economic sectors in the community. The medium ranking of the expenditure-based sector dependence index accounted for a third (33%) of the ordinal patterns in the BSLMF (Table 16).

Table 15. Sector dependence indices for communities in the Bas-Saint-Laurent Model Forest, based on three methods of calculating dependence

	Sector; sector dependence index[a]		
Community and sector	Employment	Income	Expenditure
Auclair			
Agriculture	0.408	0.697	0.445
Forestry	0.269	0.285	0.248
Construction	0.064	0.033	0.061
Government	0.071	0.000	0.067
Service industry	0.189	0.024	0.179
Biencourt			
Agriculture	0.105	0.012	0.142
Forestry	0.658	0.945	0.688
Construction	0.093	0.019	0.060
Service industry	0.093	0.004	0.073
Transfers	0.051	0.020	0.037
Dégelis			
Agriculture	0.126	0.041	0.131
Forestry	0.451	0.569	0.460
Service industry	0.133	0.028	0.131
Transfers	0.285	0.362	0.273
Other	0.005	0.000	0.005
Esprit-Saint			
Forestry	0.611	0.731	0.758
Service industry	0.087	0.022	0.065
Transportation	0.070	0.006	0.052
Transfers	0.232	0.241	0.126
La Rédemption			
Agriculture	0.071	0.007	0.103
Forestry	0.268	0.073	0.471
Construction	0.035	0.003	0.008
Mining	0.072	0.020	0.158
Transfers	0.554	0.897	0.260
La Trinité-des-Monts			
Agriculture	0.287	0.000	0.211
Forestry	0.554	0.801	0.700
Government	0.057	0.040	0.031
Transfers	0.102	0.160	0.059
Lac-des-Aigles			
Agriculture	0.034	0.006	0.100
Forestry	0.332	0.375	0.407
Mining	0.053	0.019	0.147
Service industry	0.016	0.000	0.013
Transportation	0.161	0.096	0.217
Transfers	0.363	0.502	0.084
Other	0.041	0.002	0.031

Table 15. Continued

Community and sector	Sector; Sector dependence index[a]		
	Employment	Income	Expenditure
Notre-Dame-du-Lac			
Agriculture	0.091	0.060	0.110
Forestry	0.360	0.416	0.258
Construction	0.052	0.011	0.023
Government	0.344	0.424	0.483
Service industry	0.032	0.013	0.041
Transfers	0.120	0.077	0.093
Saint-Charles-Garnier			
Agriculture	0.220	0.116	0.225
Forestry	0.251	0.137	0.261
Transfers	0.529	0.747	0.514
Saint-Eugène-de-Ladrière			
Agriculture	0.122	0.020	0.017
Forestry	0.390	0.435	0.620
Construction	0.200	0.198	0.214
Professional or financial services	0.005	0.000	0.005
Service industry	0.020	0.000	0.093
Transfers	0.263	0.347	0.051
Saint-Juste-du-Lac			
Agriculture	0.124	0.010	0.084
Forestry	0.338	0.202	0.771
Transfers	0.538	0.788	0.145
Saint-Médard			
Forestry	0.302	0.085	0.224
Service industry	0.059	0.006	0.004
Transfers	0.639	0.908	0.772
Saint-Narcisse-de-Rimouski			
Agriculture	0.244	0.147	0.059
Forestry	0.454	0.582	0.436
Mining	0.045	0.005	0.310
Service industry	0.026	0.003	0.070
Transportation	0.075	0.032	0.069
Transfers	0.156	0.230	0.056
Saint-Valérien			
Agriculture	0.117	0.047	0.046
Forestry	0.255	0.275	0.130
Construction	0.264	0.479	0.212
Government	0.011	0.007	0.013
Mining	0.123	0.078	0.099
Service industry	0.063	0.000	0.054
Transportation	0.166	0.114	0.445

Table 15. Concluded

Community and sector	Sector; Sector dependence index[a]		
	Employment	Income	Expenditure
Saint-Zénon-du-Lac-Humqui			
Agriculture	0.112	0.017	0.024
Forestry	0.462	0.310	0.673
Transfers	0.427	0.674	0.303
Sainte-Irène			
Agriculture	0.213	0.183	0.163
Forestry	0.289	0.394	0.387
Government	0.099	0.016	0.048
Service industry	0.179	0.115	0.129
Transfers	0.220	0.292	0.273
Bas-Saint-Laurent Model Forest			
Agriculture	0.128	0.100	0.134
Forestry	0.394	0.303	0.393
Construction	0.037	0.049	0.036
Government	0.037	0.045	0.055
Mining	0.017	0.026	0.011
Service industry	0.061	0.037	0.071
Transportation	0.025	0.025	0.032
Transfers	0.296	0.414	0.266
Other	0.003	0.002	0.004

Note: Columns may not sum to exactly 1.00 because of rounding.
[a]There were a total of 11 sectors: agriculture, construction, forestry, professional or financial services, oil and gas (energy), government, mining, service industry, transportation, transfers and other. Sectors with a value of zero for all three dependence measures for a particular community (or the model forest as a whole) are not presented in this table. A zero value for the income-based sector dependence index means that no base income data were available in that sector within the community.

Table 16. Summary of ordinal ranking of sector dependence indices (SDIs) by economic sector[a]

Economic sector	Ordinal ranking of the employment, income and expenditure SDIs[b]; no. of communities								Total no. of communities
	MLH	LMH	HLM	LHM	HML	MHL	LH[c]	HL[c]	
Agriculture	6		2	1	4			1	14
Forestry	4	3	1	4		4			16
Construction	1		4			1		1	7
Professional and financial services							1[d]		1
Government	1	1	1		1			1	5
Mining	3			1					4
Service industry	2		5		1		1	2	11
Transportation	2		2						4
Transfers			2	2		10			14
Other			1					1[e]	2
No. of combinations of sector and ranking	19	4	18	8	6	15	2	6	78

[a]The oil and gas sector is not included in this table because its economic contribution was very small and the SDIs = 0.
[b]Ordinal rankings for each SDI indicated by letter combinations, where H = high, M = medium, L = low.
[c]Ordinal ranking of employment and expenditure SDIs, because no base income data were available for the applicable communities or the employment and income SDIs had the same value.
[d]All indexes had the same value; arbitrarily assigned to the LH category.
[e]All indexes had the same value; arbitrarily assigned to the HL category.

SUMMARY AND CONCLUSIONS

Community resource dependence has traditionally been studied in terms of the degree to which a community depends on the natural resource sector to provide employment and income for its residents. The present study has examined community dependence more broadly by including all of the sectors that make up a community's economy. In particular, this study has examined the effect of the nonbase sector on traditional measures of dependence through the addition of household expenditure leakage to the economic base model. As mentioned earlier, Robertson (2003) noted that the effect of leakage may not be adequately accounted for in the practical implementation of the economic base hypothesis. This study accounted for the effect of leakage to determine its effect on traditional measures of community dependence and to place community dependence in a broader context.

Forest dependence, and resource dependence more generally, can be measured in a number of ways, but the extent of employment in the sector relative to employment in all sectors has been used in many studies (e.g., Stedman et al. 2007). There are 918 forest-dependent communities in Canada, with dependence defined as at least 10% of employment in forestry (Stedman et al. 2005). In the current study, forestry was the only economic sector that played a role in the economy of all of the communities surveyed in the BSLMF household expenditure survey. This characteristic and the high values of the employment-based sector dependence indices for the forestry sector (Table 15) suggest that the CSDs in the survey are communities that depend heavily on forestry. However, the forestry sector and the other economic sectors were not by themselves significant in explaining household expenditure leakage in the all-products model; rather, they seemed to influence leakage largely through income. Because the transfers sector had the lowest average income of all sectors and displayed a strong degree of low dependence (Table 16), two additional models, an all-products model and a durables-only model, with transfers removed from their respective data sets, were investigated to determine whether the transfers sector accounted for the sign and significance of the income coefficient in the broader models. The coefficient for income remained significant and its sign did not change from the broader models shown in Tables 10 and 12.

Other household and community characteristics that were significant drivers of income leakage were level of attained education, family type, home community population, population-weighted spending, and the travel distances to destination communities. The relationship between population-weighted spending, and expenditure leakage and that between expenditure leakage and income were particularly interesting. The latter suggested that the incentive to seek the lower prices or wider selection, or a combination thereof, offered in destination communities became stronger as income fell, whereas the former suggested that a higher proportion of income was spent on consumer goods and services as income fell. This may be because, as income declines, less after-tax income is diverted to savings and expenses, which by definition are in the home community.

Three types of sector dependence indices were determined for each of the base economic sectors for 16 communities in the BSLMF. In 55% of the combinations of sector and community, the income-based sector dependence index suggested that the community in question was less dependent on the applicable economic sector than the employment-based index would have suggested. However, when the employment- and income-based methods were compared with the index based on household expenditures, there were notable differences. About 35% of the combinations of sector and community (Table 16) had low dependence on their respective communities when the expenditure-based sector-dependence index was factored into the analysis. The transfers sector figured prominently in the calculation of this percentage, which dropped to 22% when transfers were not included. Also, and somewhat paradoxically, there was a preponderance of communities with low dependence on the agriculture and forestry sectors, with almost a third (30%) of

the communities displaying this characteristic (Table 16). The reasons for this finding are unclear, but it may be a function of the unusual form of forestland tenure in the BSLMF, which may promote purchases for the home while working away from home on private woodlots. Use of the local expenditure-based sector dependence indices to gauge dependence in its broader sense suggested that two-thirds (67%) of the combinations of income- and employment-based sector dependence indices were biased: they did not reflect the degree of dependence that communities actually had on all of the sectors making up their economies. This figure dropped to just over half (54%) when transfers were omitted and to 27% when agriculture, forestry, and transfers were omitted. The household expenditure surveys were conducted about 10 years ago, and community characteristics and circumstances have changed in the interim. Nonetheless, this analysis has illustrated the ability of expenditure leakage data to reveal the potential biases inherent in sector dependence indices that are based on employment- or income-based location quotients.

The degree of bias was even higher when the model forest as a whole was examined. For the entire model forest, eight of the nine sectors (see last section of Table 15) had a "low or high" ranking for the expenditure-based sector dependence index, which suggests that these sectors did not reflect the degree of dependence suggested by their employment- and income-based sector dependence indices when examined in relation to the expenditure-based sector dependence index. The forestry sector was the only sector that had a "medium" ranking for the expenditure-based sector dependence index, which suggests that the proportion of sector income spent locally was about average with respect to the other economic sectors in the model forest. This characteristic may be a reflection of the relatively high number of "medium" ordinal rankings of the forestry sector's expenditure-based sector dependence index shown in Table 16. The summary for the model forest (Table 15) also highlights the significance of the forestry and transfers sectors, which collectively accounted for about 72% of the base income in the region.

Percent expenditure leakage can also serve as an indicator of the impact that an economic shock is likely to have on a community as a whole. For example, a community with high expenditure leakage, such as Saint-Valérien, with seven economic sectors, may not be significantly affected by a small decrease in income from forestry, such as the 0.778% decrease that Lantz and Yigezu (2003) estimated would occur in response to a 1% decline in the price of lumber in a New Brunswick community. Investigation of the effect of leakage on the impact of positive or negative economic shocks is an area for further research, as is an even more fundamental investigation of leakage changes with respect to economic shocks. Concurrent developments such as a decrease in population through out-migration could amplify any negative effects on a community that a drop in income might engender.

There are, of course, many other model forests that could be investigated to shed more light on the factors influencing household expenditure leakage. Further studies may reveal extensive differences between regions, such as those noted by Williamson et al. (1999) between western and eastern forest-dependent communities. Further research may lend additional weight to the finding in this work that employment-based and income-based measures of dependence are prone to misinterpretation because of the common assumption that income earned in a community is spent within that community (Jagger et al. 1998). Perhaps, then, the degree of household expenditure leakage is one of many valid indicators of community health, well-being, and, ultimately, sustainability.

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APPENDIX 1

TELEPHONE QUESTIONNAIRE SCRIPT – BAS- ST.-LAURENT MODEL FOREST

Hello. May I please speak to the person responsible for making your household's purchasing decisions?

If this person is not available:

When would be a good time to call this person back?
RECORD this time on the CATI terminal for a callback

Once connected with person:

Good morning/afternoon. I understand that you are responsible for making purchasing decisions for your household. Is this correct?

Yes Proceed
No Ask to speak with correct person

This is [NAME] of Advantage Field Research in Edmonton, Alberta. We are doing a marketing research study on behalf of the Canadian Model Forest Network to find out about household spending patterns in the Bas-St.-Laurent area. Your number was one of about two thousand households in the area which have been randomly chosen for an interview. All responses will remain confidential. Could you take about 10 minutes to answer a few questions for me?

Yes Proceed
No I thank you for your time. Goodbye.

1. Where do you live? **[Do not read list]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots–Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste. Jeanne-d'Arc
14. Ste.-Irène
15. Lac Humqui

2. For the next question, I will read a list of different types of products and services. For each, we would like you to tell us in which town or city you USUALLY buy each type of product or service for your household. Answer the following questions as a representative of your household.

2a. To begin with, in which town or city do you usually buy the food you purchase from a grocery store? Do you usually buy it in **[Read list except Never Purchase]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9 St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

2b. Next, where do you usually buy the meals you purchase from restaurants? **[Read list except Never Purchase]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

2c. Where do you usually buy household supplies such as child care products, pet supplies, and/or household cleaning supplies? **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. FROM A CATALOQUE OR THE INTERNET
20. OTHER (SPECIFY) _____
21. NEVER PURCHASE **[Do not read]**

2d. Where do you usually buy clothing? **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. FROM A CATALOQUE OR THE INTERNET
20. OTHER (SPECIFY) _____
21. NEVER PURCHASE **[Do not read]**

2e. Where do you usually buy fuel for your vehicles? **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

2f. Where do you usually go for dental and optical services? **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

2g. Where do you usually buy medication purchased at a pharmacy? **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

2h. Where do you usually go for spectator events and entertainment such as concerts, live sporting events, and movies? **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

2i. Where do you usually buy computer equipment and software including computer games? **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
18. FROM A CATALOQUE OR THE INTERNET
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

2j. Where do you usually buy tobacco and alcohol products? **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

2k. Where do you usually buy reading material and other printed matter? **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. FROM A CATALOQUE OR THE INTERNET
20. OTHER (SPECIFY) _____
21. NEVER PURCHASE **[Do not read]**

2l. Where do you usually buy other small items such as small gifts, toys, games or accessories? **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. FROM A CATALOQUE OR THE INTERNET
20. OTHER (SPECIFY) _____
21. NEVER PURCHASE **[Do not read]**

3. What is the most important reason why you purchase your day to day goods in these communities? Is it because of **[Read list, Single response]**

1. Lower Price
2. More Convenient
3. Wide selection of products
4. To support local business or
5. Other **Record response** _____

4. Now we would like to continue with some larger items. In which town or city do you, or would you, buy the following items?

4a. Furniture, appliances **[Read list except Never Purchase]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard9.
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. FROM A CATALOQUE OR THE INTERNET
20. OTHER (SPECIFY) _____
21. NEVER PURCHASE **[Do not read]**

4b. Home entertainment equipment **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. FROM A CATALOQUE OR THE INTERNET
20. OTHER (SPECIFY) _____
21. NEVER PURCHASE **[Do not read]**

4c. Sporting and recreational equipment such as camping equipment, skiing and golf equipment, bicycles, or fishing equipment **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc.
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. FROM A CATALOQUE OR THE INTERNET
20. OTHER (SPECIFY) _____
21. NEVER PURCHASE **[Do not read]**

4d. Recreational vehicles such as ATV's, boats, snowmobiles, and dirt bikes **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

4e. New cars and trucks **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

4f. Used cars and trucks **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

4g. Motor homes and travel trailers **[Read list if necessary]**

1. Notre-Dame-du-Lac
2. St.-Juste-du-Lac
3. Lots-Renverses
4. Auclair
5. Lejeune
6. Biencourt
7. Lac-des-Aigles
8. St.-Médard
9. St.-Eugène-de-Ladrière
10. St.-Valérien
11. St.-Charles-Garnier
12. Ste.-Angèle-de-Mérici
13. Ste.-Jeanne d'Arc
14. Ste.-Irène
15. Lac-Humqui
16. Rivière-du-Loup
17. Rimouski
18. Edmunston
19. OTHER (SPECIFY) _____
20. NEVER PURCHASE **[Do not read]**

5. What is the most important reason why you purchase your major goods in these communities? Is it because of **[Read list, Single response]**

1. Lower Price
2. More Convenient
3. Wide selection of products
4. To support local business or
5. Other **Record response** _____

6. When you go on vacation, where do you usually go? **[Do not read list. Probe if you are unsure which category the response falls into. Single response]**

1. Camping at the beach in the Bas-St.-Laurent area
2. Other Places Within Quebec
3. Outside Quebec
4. Don't Go On Vacation

Finally, I would like to ask you some questions about yourself and your household to help classify individuals for this study.

7. What is the highest level of education that you have completed? Please stop me when I have read your category. **[Read List except refused]**

   1. Never attended school
   2. Grade school (Grade 1 to 9)
   3. Some high school
   4. High school graduate
   5. Technical school
   6. Some college or university
   7. Undergraduate university degree
   8. Graduate degree
   9. Refused **[Do not read this response]**

8. Which of the following categories includes your age? Again, please stop me once I have read your category. **[Read list except refused]**

   1. 18 to 25 years
   2. 26 to 35 years
   3. 36 to 45 years
   4. 46 to 55 years
   5. 56 to 65 years
   6. Over 66
   7. Refused **[Do not read this response]**

9. How many of the OTHER people that live in your household fall into each of the following age categories? **[Read list except refused]**

   _____ Under 18 years
   _____ 18 to 25 years
   _____ 26 to 35 years
   _____ 36 to 45 years
   _____ 46 to 55 years
   _____ 56 to 65 years
   _____ Over 66
   _____ Refused **[Do not read this response]**

10. Household members may be employed outside the home, self-employed, homemakers, retired, students, or others who are not working. Remembering to include yourself, how many of the people over 18 in your household fall into each of the following groups? **[Read list]**

    _____ Employed outside the home
    _____ Self-employed
    _____ Homemakers
    _____ Retired
    _____ Students
    _____ Others not working
    _____ Refused **[Do not read this response]**

11. Please identify which of the following industries or other sources of income currently contribute to your household's income. **[Read complete list except refused. Multiple responses]**

    1. Agriculture
    2. Construction
    3. Forestry
    4. Financial Sector
    5. Oil and Gas
    6. Government Worker
    7. Professional
    8. Mining
    9. Service Industry
    10. Transportation
    11. Canada Pension Plan and/or Private Pension Income
    12. Investment Income
    13. Social Assistance Payments and/or Unemployment Insurance
    14. Other industry **[Record response]** _____
    15. Refused **[Do not read]**

12. Of the above sources of income, which source provides most of your household's income? **[Read list of their responses if necessary. Single response only.]**

    1. Agriculture
    2. Construction
    3. Forestry
    4. Financial Sector
    5. Oil and Gas
    6. Government Worker
    7. Professional
    8. Mining
    9. Service Industry
    10. Transportation
    11. Canada Pension Plan and/or Private Pension Income
    12. Investment Income
    13. Social Assistance Payments and/or Unemployment Insurance
    14. Other industry **[Record response]** _____
    15. Refused **[Do not read]**

13. Which of the following categories best describes your household's total earnings, before taxes for 1998? **[Read list except refused]**

    1. $15,000 or less
    2. $15,001 to $20,000
    3. $20,001 to $30,000
    4. $30,001 to $40,000
    5. $40,001 to $50,000
    6. $50,001 to $60,000
    7. $60,001 to $70,000
    8. $70,001 to $80,000
    9. $80,001 to $90,000
    10. $90,001 to $100,000
    11. $100,001 to $110,000
    12. $110,001 to $120,000
    13. More than $120,000
    14. Refused **[Do not read this category]**

Those are all of the questions I needed to ask you. Thank-you for taking the time to help the Canadian Model Forest Network with this study. Goodbye.

End of Survey

Record Gender

1. Male
2. Female

APPENDIX 2

AN EXAMPLE OF A CALCULATION OF HOUSEHOLD EXPENDITURE FOR A PRODUCT CLASS USING THE MODIFIER CALCULATION

We have modified the data in the *Family Expenditure in Canada 1996* survey to align it as closely as possible with actual expenditures in the BSLMF region. This was done by taking the expenditure level reported in the survey for a given product class and modifying it to concurrently reflect the rural nature of BSLMF communities and the income and the family structure of the survey respondents. Each of these three components was given equal weight in calculating the modifier. An example for clothing expenses is provided below.

From the *Family Expenditure in Canada 1996* survey we know that the average Quebec family spends $2 017 on clothing. For a household included in the BSLMF expenditure survey with an income of $50 000 to $59 999, composed of two adults and two children, we would make the following modifications. First, we determined the difference between expenditures of rural non-farm inhabitants (as residents of the BSLMF are classed) and the average Quebec expenditure for clothing as reported in the *Family Expenditure in Canada 1996* survey. The average Quebec rural expenditure for clothing was $1 892 leaving a difference of $125 or about 6% less than the overall Quebec average. The average expenditure for clothing by all Quebec households with incomes of $50 000 to $59 999 was $2 492 or a difference of $475 or 23% more. Finally, we compared the average family expenditure for clothing with the average clothing expenditure for this family type in Quebec. A Quebec household with two adults and two children spends an annual average of $2 795 on clothing, $778 (39%) more than the Quebec average. As we are weighting these modifications equally, we sum the three modifications and divide by three to obtain the overall modifier for this case. This is shown below.

Rural non-farm (-0.062)+ Income (+0.235)+ Family type (0.386), divided by 3 = +0.186. The modifier used for this particular product class for the above family type was +0.187 or an increase of 18.7% over the Quebec average expenditure of $2 017. In this example the family would have spent $2 392 on clothing. This was repeated for all product classes for all survey respondents.

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