Provincial Variations in the Determinants of Retrofitting Behaviour in the Context of the CHIP and COSP Programmes: II. Household Characteristics

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This is the second of two research notes that assess provincial variations in retrofitting behaviour in the context of the Canadian Home Insulation Programme (CHIP) and the Canadian Oil Substitution Programme (COSP). CHIP was designed to upgrade the thermal efficiency of Canadian housing, and COSP was intended to reduce residential dependency on oil.[1] The first note (Ferguson et al. 1991) examined dwelling characteristics as determinants of retrofitting behaviour. This note studies the importance of the socio-economic characteristics of households in the decision to retrofit. Moreover, the results of each study are integrated and considered in light of future conservation incentives.

1. See Ferguson et al. (1991) for a detailed description of the programmes.

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The determinants of retrofitting are studied with the aid of the Household, Income, Facilities, and Equipment (HIFE) data set described in the first article. The first section of this article examines past studies of socio-economic variables and their effects on conservation actions. In the second section, the relationship of individual variables to retrofitting behaviour is analyzed. Specification of the logit model then sets the stage for the multivariate analysis. In this context, the differing role of each variable across the provinces is considered. An important aspect of the study is the ability of each variable to predict insulation improvements versus equipment improvements.

Background Literature

The relationship between socio-economic variables and retrofitting behaviour has been analyzed far more than that of dwelling characteristics and retrofitting behaviour. Socio-economic variables figuring prominently in previous studies have been household income and two characteristics of the household head: age and level of education. These variables are discussed in this review.

For income, the results are mixed. Curtin (1976) concludes that there is no systematic relationship between income and conservation practices. Walsh (1989), in contrast, in his study of tax credits found income to be an excellent predictive variable. Perhaps this finding reflects more the superior ability of high-income people to recognize and take advantage of tax credits than it does their willingness to conserve. If there is a uniform theme in the literature, it is that the middle class is more likely to make energy improvements than high- or low-income households. In this respect, Smiley (1979) argues that because high-income households have more insulation in place to begin with, the incentive to retrofit is not so great. He also finds, however, that low-income households are the least likely to make improvements. Tonn and Berry (1986) find that income is a far better predictor of participation in an audit programme, where a dwelling is appraised for thermal efficiency, than in predicting usage of home improvement loans. It seems that high-income people are happy to have their homes audited even if only to confirm that it is thermally efficient.

Such life-cycle variables as age of household head have produced a variety of interesting findings. For the most part, it has been revealed that the tendency to retrofit increases up until middle age (that is, from ages 35 to 45) and then decreases thereafter. Young people in their twenties are more likely to be members of mobile, one- or two-person households (Laquatra and Chi 1989), which use considerably less energy than more mature households (Fritzsche 1981). Elderly residents are not expected to have long tenures in their current dwellings (Smiley 1979; Mendelsohn 1977) and are less adaptable to the minor changes in lifestyle that conservation activity tends to cause (Curtin 1976). Elderly people, therefore, are probably the least likely to conserve. It follows that assistance programmes should focus more on the elderly, who often stay in their large and older family homes instead of moving to specialized housing or smaller accommodations (Macey 1988). In contrast, middle-aged household heads are reasonably well settled, with the longest expected tenure in their current dwellings. Furthermore, they live in the largest dwellings and have the highest household consumption of energy (Fritzsche 1981; Smiley 1979; Walsh 1989). Thus, the incentive to conserve for members of this group is substantial.

Finally, level of education is generally positively correlated with conservation activity, but the relationship is not strong. Education is a much better surrogate of conservation activity when assessing participation in home audit programs and such cost-free measures as turning out lights (Tonn and Berry 1986; Laquatra and Chi 1989). This variable does not excel, however, in predicting more capital-intensive improvements.

Univariate Analysis

Five variables related to socio-economic and household characteristics are taken from the data, some of which have been discussed extensively in the literature. This section will illustrate how these variables have generally affected the tendency to retrofit. A more thorough description of the variables and their interrelationships is reserved for the multivariate analysis. Because of data limitations, only the retrofitting activity of owner-occupied housing from 1979 to 1982 is analyzed in Table 1 and in the logit model that follows.

The variable "number of children" acts as a surrogate for household mobility. This variable tends to covary with age of the household head, size of the housing unit, and presence of a spouse. Table 1 shows that the tendency to retrofit in Canada seems to increase with the number of the children. The best-defined division in retrofitting behaviour, however, is whether indeed the household has children as opposed to how many.

The variable "education of wife" better represents the retrofitting decision as a choice made by well-educated spouses than the variable "education of household head". Households without a wife are less likely to retrofit (Table 1). The level of education up to the completion

TABLE 1 Retrofitters versus Non-retrofitters for Various Household Characterictics (millions of households)

	Non-retrofit		Retrofit		Total	
	No.	%	No.	%	No.	%
A. No. of Children						
None	1.032	(43.4)	0.892	(38.9)	1.923	(41.2)
One	0.442	(18.6)	0.414	(18.0)	0.856	(18.3)
Two	0.544	(22.9)	0.573	(25.0)	1.116	(23.9)
Three	0.247	(10.4)	0.284	(12.4)	0.532	(11.4)
Four or more	0.115	(4.7)	0.131	(5.7)	0.246	(5.2)
B. Education of Wife						
No wife	0.544	(22.9)	0.396	(17.3)	0.941	(20.1)
No schooling, elementary	0.415	(17.4)	0.412	(18.0)	0.827	(17.7)
Up to high school	0.992	(41.7)	0.961	(41.9)	1.953	(41.8)
Postsecondary	0.427	(18.0)	0.524	(22.9)	0.952	(20.4)
C. Type of Area						
Urban > 100,000	1.200	(50.5)	1.126	(49.1)	2.327	(49.8)
Urban 30,000-100,000	0.202	(8.5)	0.202	(8.8)	0.404	(8.6)
Urban < 30,000	0.425	(17.9)	0.405	(17.6)	0.829	(17.8)
Rural	0.551	(23.2)	0.561	(24.5)	1.112	(23.8)
D. Annual Household Income						
< \$15,000	0.524	(22.0)	0.437	(19.0)	0.960	(20.5)
≥ \$15,000-< \$30,000	0.748	(31.4)	0.767	(33.4)	1.515	(32.4)
≥ \$30,000-< \$45,000	0.653	(27.4)	0.654	(28.5)	1.307	(28.0)
≥ \$45,000	0.455	(19.1)	0.436	(19.0)	0.891	(19.1)
E. Age of Household Head						
< 30	0.226	(9.5)	0.207	(9.0)	0.433	(9.3)
30-49	1.034	(43.4)	1.040	(45.4)	2.073	(44.4)
50-64	0.659	(27.7)	0.678	(29.6)	1.337	(28.6)
≥ 65	0.460	(19.3)	0.369	(16.1)	0.828	(17.7)
Total	2.379	(100.0)	2.293	(100.0)	4.672	(100.0)

Note: Chi-square A: 1,485; B: 3,280; C: 139; D: 694; E: 961. Significance: 0.000 in all cases.

of high school does not influence retrofitting behaviour, but having at least some postsecondary education increases the chances of retrofitting.

There is little evidence that retrofitting behaviour in general is influenced by the type of area in which the dwelling is located (Table 1). Specific types of retrofitting behaviour, such as upgrading heating equipment, might show more clearly defined relationships. Overall, it appears that residents of urban areas are somewhat less likely to retrofit than those of rural areas.

As is apparent in Table 1, where the data are grouped into four income categories for display purposes, there is surprisingly little differentiation between retrofitters and non-retrofitters on the basis of total annual household income. It appears that the lowest income group (< \$15,000) is less likely to retrofit, a finding consistent with those in the study by Smiley (1979).

Finally, for the variable "age of household head", there is evidence in Table 1 that the tendency to retrofit increases up to middle age and then decreases thereafter, a trend consistent with the studies discussed previously. Citizens of retirement age have the greatest tendency not to retrofit.

Multivariate Analysis

To analyze further the socio-economic and household determinants of retrofitting behaviour, the following binary logit model is utilized:

$$\ln(P_1/P_0) = \beta_0 + \beta_1 X_1 + \ldots + \beta_n X_n$$

where P_0 and P_1 are the probabilities of not retrofitting and retrofitting respectively; $X_1 \ldots X_n$ are independent variables; and $\beta_0 \ldots \beta_n$ are parameters to be estimated. The dependent variable related to energy improvements was formed in an identical manner to the response variable analysis performed in the first note for dwelling characteristics (Ferguson et al. 1991). The independent variables consist of nine variables (x_1-x_9) linked to the five household characteristics retained above. In the case of households that retrofit, they take the following values:

x_1 = number of children.
x_2 = 1 for households without a wife; 0 otherwise.
x_3 = 1 for households in which the wife has no schooling or only an elementary education; 0 otherwise.
x_4 = 1 for households in which the wife has up to a secondary education; 0 otherwise.
x_5 = 1 for households in urban areas of 100,000 inhabitants or more; 0 otherwise.
x_6 = 1 for households in urban areas of between 30,000 and 100,000 inhabitants; 0 otherwise.
x_7 = 1 for households in urban areas of less than 30,000 inhabitants; 0 otherwise.
x_8 = annual household income.
x_9 = age of the household head.

In the case of households who do not retrofit, all these variables are naturally taken equal to zero. Note that the definition of the dummy variables x_3-x_7 implies consideration of a base category of rural households with a wife having had a postsecondary education.

The model is calibrated twice: first, to contrast those who undertake at least some insulation improvement (CHIP) with those who perform no energy improvement, and, second, to compare those who improve their heating equipment (COSP) with those who make no improvement. The SPSS-PC logistic regression program was used to estimate the model parameters, and the rho-squared statistic is calculated from the results provided.

The constant terms shown in the models in Tables 2 and 3 are in many instances not significantly different from zero. This implies that for the independent variables used, similar households in the base category are equally likely to choose either of the two alternatives. In general, the constant terms in the equipment models are less than those in the insulation models, which implies that otherwise similar households in the base category are more likely to upgrade their home's insulation than its heating equipment. The smallest constants are found in the Alberta models, a finding that confirms the low participation rate of Albertans in the CHIP and COSP programmes. This lower participation rate can be explained by greater energy security and lower energy costs as well as a newer, more energy-efficient housing stock. Furthermore, since approximately 90 percent of the housing stock was heated with natural gas, participation in the COSP programme was redundant for most households.

Number of Children

The variable "number of children" appears to be significant only in eastern Canada, where it is positively associated with retrofitting improvements. A household with children is likely to be immobile, with a longer tenure expected in the current residence. Such families have more interest in improving their present dwelling. The presence of children also may explain a greater propensity to plan for the future. Such families would be more likely to invest when their children are small in order to reap savings in the future. Table 1 indicates that households with two or more children are considerably more likely to retrofit, but this likelihood does not increase proportionally with the number of children. Households with no children or one child apparently retain sufficient mobility to deter them from retrofitting.

There is no reason to believe that the number of children predicts equipment improvements better than insulation improvements, and this is confirmed in Tables 2 and 3. The relative success of this variable in the eastern provinces is indicative of a trend: socio-economic

TABLE 2 Results of the Binary Nested Logit Analysis by Province: Insulation Improvements versus No Energy Improvements

Household Characteristic	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC
Number of Children	0.21***	0.10	0.09**	0.06	0.06*	0.08	-0.04	-0.06	-0.01	0.04
Education of Wife										
No wife	0.04	-0.47	-0.59***	-0.26	-0.21	-0.80***	-0.36**	-0.46***	-0.44***	-0.86***
No school, elementary	0.46**	-0.53**	-0.32*	-0.18	-0.10	-0.44***	-0.13	-0.25*	-0.23*	-0.30*
Secondary	0.18	0.09	-0.04	-0.05	-0.24*	-0.31***	-0.06	-0.27**	-0.27**	-0.27**
Type of Area										
> 100,000	—	—	—	—	-0.51***	0.15	0.00	0.31***	0.02	0.21*
30,000-100,000	0.00	—	0.15	0.27**	-0.19	0.04	—	—	-0.18	-0.12
< 30,000	-0.25**	-0.11	0.07	0.04	-0.24**	0.10	0.01	-0.08	0.12	0.21
Annual Household Income	0.00	0.01	0.01**	-0.00	0.00	-0.01***	0.00	0.00	0.00	-0.00
Age of Household Head	-0.00	0.00	-0.01*	0.01*	0.00	-0.00	-0.00	0.00	0.01	-0.00
Constant	-0.03	-0.28	-0.01	-0.65**	-0.23	0.58***	0.40	0.23	-1.01***	-0.52*
Sample size	1,406	552	1,470	1,548	2,605	3,470	1,838	2,375	2,462	2,044
Rho-squared	0.04	0.03	0.03	0.01	0.01	0.01	0.01	0.01	0.01	0.02

* Significant at 0.1.
** Significant at 0.05.
*** Significant at 0.01.

variables are more significant in those provinces where dwelling characteristic variables are less significant. Thus, retrofitting behaviour in the Maritimes appears to be regulated more by socio-economic constraints than by dwelling characteristic constraints. As discussed earlier in Ferguson et al. (1991), Maritimers exhibited a greater degree of conservation awareness than the residents of other provinces. As a result, an eastern homeowner's retrofitting activity was less likely to be curtailed by having, for example, a newer or smaller dwelling, but was more likely to be limited by such socio-economic factors as income. Residents of Alberta and British Columbia were more likely to retrofit because of obvious circumstances such as having an extremely old dwelling.

Education of Wife

The variable "education of wife" represents the retrofitting choice as a joint decision between well-educated spouses with mutually reinforcing viewpoints. Such a decision often results in retrofitting activity. Households with a well-educated wife are probably more sensitive to media coverage of energy and environmental issues and exhibit a greater tendency toward long-term planning. Also, this variable captures the effect of higher incomes and larger homes.

In the early stages of analysis, education of wife performed better as a variable than the education of household head. As a result, it is the variable retained in the final model. According to Tables 2 and 3, the presence of a wife, as well as the level of education of a wife, tend to improve the chances of retrofitting. There is no evidence to indicate that the presence of a wife makes a difference between insulating or improving equipment. But a wife's level of education is a better predictor of upgrading equipment than of insulating. A wide range of equipment improvements with many options was available under a COSP grant, and the increased expenditure associated with these measures made the decision to improve equipment even more complex. Thus, a wife's higher education became important. In contrast, contractors aggressively marketed CHIP as an attic insulation program (Energy, Mines and Resources 1983; Fenton 1983), a tendency that simplified the insulation programme and made the decision to insulate less complex. As a result, the level of education should predict equipment measures more effectively.

This hypothesis was confirmed in central Canada, but the "education of wife" variable performed poorly in predicting equipment improvements in western Canada, where the heating equipment stock was powered by non-oil fuels in the great majority of households. The impact of this variable was minimal in the Maritimes because, as

TABLE 3 Results of the Binary Nested Logit Analysis by Province: Equipment Improvements versus No Energy Improvements

Household Characteristic	Nfld	PEI	NS	NB	Que	Ont	Man	Sask	Alta	BC
Number of Children	0.12***	0.16	0.13***	0.09*	0.03	0.03	0.07	0.01	-0.07	0.03
Education of Wife										
No wife	0.54***	-0.65	-0.61**	-0.48*	-0.53***	-0.67***	-1.00***	-0.45*	-0.21	-0.75***
No school, elementary	0.08	-0.84	-0.42**	-0.13	0.19***	-0.57***	-0.85***	-0.01	-0.14	-0.30
Secondary	0.01	0.07	0.00	0.11	-0.47***	-0.45***	-0.46**	-0.10	-0.43*	0.03
Type of Area										
> 100,000	—	—	—	—	-0.36***	-0.40***	-0.81**	-0.94***	-0.97**	-0.70***
30,000-100,00	—	—	-0.27	-0.07	0.22**	-0.34**	—	—	-1.09***	-0.17
< 30,000	-0.29***	-0.39	-0.40**	-0.47***	-0.10	-0.09	-0.32*	-0.29*	-0.58***	-0.18
Annual Household Income	-0.00	0.02	0.00	-0.00	-0.00	0.00	-0.01	-0.00	-0.00	0.00
Age of Household Head	-0.02***	-0.00	-0.02***	-0.01***	-0.00	-0.01**	0.01	-0.00	0.01	0.00
Constant	0.51**	-0.66	0.30	0.15	-0.54***	0.07	-0.31	-0.84**	-1.61***	-0.72**
Sample size	921	482	1,174	1,340	2,157	2,590	1,223	1,438	1,807	1,888
Rho-squared	0.05	0.07	0.06	0.04	0.01	0.03	0.04	0.02	0.04	0.03

* Significant at 0.1.
** Significant at 0.05.
*** Significant at 0.01.

noted earlier, people at all education levels were more uniformly informed about CHIP and COSP.

The success of the variable in central Canada, particularly Ontario, reflects the fact that these programmes peaked there in the early eighties, a bit later than in the Maritimes (where a considerable amount of retrofitting activity occurred before 1979-1982). Based on these results, it can be argued that level of education is most important as such programmes reach their peak (that is, in central Canada) but decreases in importance as the population becomes more uniformly informed and the level of retrofitting activity gradually decreases (as in the Maritimes). The insulation models of western Canada, which portray a less-informed population about retrofitting, also seem to reflect this trend.

Type of Area

For equipment improvements (Table 3), the results are clear: rural areas are more likely to upgrade their equipment than urban areas, a conclusion that applies well to all provinces. This trend results from the more widespread use of natural gas and electricity in urban areas. In Alberta, for example, urban areas are served almost totally by natural gas, whereas rural households are often heated with oil or wood.

The area variable does not perform nearly as effectively in predicting insulation improvements (Table 2). The general trend is that membership in lower levels of the national urban hierarchy increases the likelihood of insulation improvements. Residents of cities lower in the national hierarchy such as Regina, Saskatoon, Saint John, and Fredericton are more likely to insulate. In contrast, residents of Quebec's large urban centres, for example, are significantly less likely to insulate. We hypothesize a stronger "do-it-yourself" mentality in larger Maritime and Prairie urban centres than in such cities as Montreal. Moreover, the greater mobility of residents in cities higher in the national hierarchy may act as a disincentive to insulation activity. While in this study residents of rural areas were more likely to upgrade equipment, the same trend did not apply to insulation improvements, which were adopted more homogeneously throughout different area types, reflecting the more general appeal of the insulation grants.

Annual Household Income

The income variable contributes little to the explanation of retrofitting behaviour. Table 1 indicates that low-income groups are less likely to retrofit, but that there is little difference in the

behaviour of the other groups. As a result, a positive relationship might be anticipated where the expectation of retrofitting increases slightly with income. Certainly, there is only one model (Ontario) in which a significant negative relationship exists, but there is also only one significant positive relationship (Nova Scotia)—see Table 2. The first case might be explained by the overall high penetration rate of CHIP into Ontario, particularly with lower-income people. Also, in such cities as Toronto higher-income people are more likely than elsewhere to live in semidetached housing or condominium units of an apartment or townhouse, all of which are less likely to be retrofitted. In the latter case, higher-income residents of Nova Scotia more often lived in dwellings needing energy improvements than similar households in other provinces.

Somewhat surprisingly, both equipment and insulation improvements were fairly evenly distributed among income groups. For equipment improvements, it can be argued that high-income people more often lived in newer, natural gas-heated dwellings whereas lower-income people were more likely to own older, oil-heated dwellings. As a result, the expected outcome that higher income people are more likely to upgrade equipment does not materialize. For insulation improvements, this finding can be explained by the popularity of cheap forms of attic insulation. Another factor may be the tendency for higher-income households to reside in newer dwellings, which are less likely to require heating system improvements and additional insulation. The failure of income as a variable is a reflection of the success of CHIP as a programme. The size of the grants and the communication of information on retrofitting were enough to convince people of all income groups to retrofit, making it more difficult to distinguish retrofitters from non-retrofitters.

Age of Household Head

Age of household head is used as a surrogate for the stage in the family life cycle. Based on the literature review, young to middle-aged household heads are the most likely to have their homes retrofitted because they have the longest expected tenures in their residence. This increased household stability results from greater employment stability and child-rearing. Also, Table 1 shows that the elderly are considerably less likely to retrofit. As a result, a negative relationship is to be expected in the majority of the models.

Where the variable is significant in the equipment improvement models, the relationship is indeed negative, but there are exceptions to this finding for the insulation models. Thus, the stage of family life cycle is a more significant factor in equipment improvements. It is more important to be well settled because the pay-back period for equipment improvements is longer than for insulation improvements, especially since CHIP grants would typically have covered a higher proportion of the costs than a COSP grant.

As for provincial variations, the most notable finding is that this variable tends to be more important in the Maritimes than elsewhere. Again, socio-economic variables are stronger where dwelling characteristic variables are not as influential. Interestingly, the age of the household head has a significantly positive relationship in Alberta when predicting an insulation improvement. This probably results from the fact that approximately two-thirds of Alberta's housing stock was built after the 1961 eligibility date for CHIP. Thus, older household heads lived in a higher proportion of the houses eligible for CHIP than in other provinces. A substantial stock of newer dwellings, less in need of retrofitting improvements, was available for younger household heads.

Conclusions

Without exception, the socio-economic variables were better able to predict heating equipment improvements than insulation improvements as the rho-squared values in Tables 2 and 3 indicate. From the point of view that equipment improvements are more costly, it makes sense that socio-economic status is more important in the retrofitting decision. It is apparent from the poor model fits that CHIP especially was successful in penetrating socio-economic barriers to retrofitting. When compared to the models introduced in the earlier note for dwelling characteristic variables (Ferguson et al. 1991), the models presented here for socio-economic variables unquestionably do not explain retrofitting as well.

A consistent theme in the analysis is the important role of infrastructure as a determinant of retrofitting behaviour. Infrastructure might refer to the lack of natural gas pipelines in eastern Canada or perhaps simply to dwelling type. Certainly, the availability of various fuel types played a substantial role in the decision to upgrade equipment. The absence of a natural gas option in the Maritimes explains the higher participation rates in COSP there. A large proportion of people, as a result, heated with oil; their fuel alternatives were electricity and wood for the most part. Because electricity was more expensive in the Maritimes, many households opted for wood, especially in rural areas. Since wood is a free fuel in much of the Maritimes and other rural areas, this is not surprising.

"Period of dwelling construction" is an important factor affecting infrastructure, and it is a critical variable in describing retrofitting behaviour. Unquestionably, it is the dominant variable in both articles. The comparative success of the socio-economic models in the Maritimes—the provinces in which the age of the dwelling had the least to do with the retrofitting decision—adds credence to the hypothesis that Maritimers are uniformly more conservation-aware than the rest of Canadians. They were apparently better informed about retrofitting measures for newer dwellings since they were no more likely to improve older dwellings than newer ones. There is no question that Maritimers had the incentive to be conservation-conscious. In the mid-seventies in Prince Edward Island, for example, electricity generation was totally dependent on oil (U.S. House of Representatives 1979). As a result, almost every household, to some extent, was dependent on oil.

The "age of household head" and "number of children" variables—determinants of the "practicality" of a retrofitting improvement—are more significant in the eastern provinces because Maritimers tended not to retrofit only in cases of very low income. Thus, there life-cycle variables are more important in relation to dwelling characteristic variables than is the case in the rest of Canada. There were many non-retrofitting households in western Canada, which acted as they did because they were unaware of the benefits of retrofitting. Moreover, the fact that the "education of wife" variable performed less well in the Maritimes was indicative of a uniformly informed population in which a good education did not necessarily mean that one was more familiar with retrofitting options.

Another noteworthy provincial model is that of Alberta, where equipment improvements were not popular primarily because 92 percent of owner-occupied households heated with natural gas. The considerable success of the area variable in this province indicated that the type of area in which someone lived was the determining factor in whether to upgrade equipment. Rural households in Alberta used oil or wood more often and thus were more likely to upgrade equipment.

Millions of Canadian households participated in the CHIP and COSP programmes and made improvements to their dwellings, but it does not follow that each of these homes is near its maximum thermal efficiency. There is evidence that the majority of CHIP grants were allocated to attic insulation (Energy, Mines and Resources Canada 1983). Accordingly, other equally needed forms of insulation were rarely installed. In other words, CHIP had a far-reaching impact, but the upgrading was not thorough. More analysis is needed to assess the extent to which retrofitted houses are still losing heat energy. As for COSP, the appropriateness of conversions should be analyzed.

Homeowners often have heating systems installed that are too large for their homes; the systems therefore function inefficiently and below capacity (Energy, Mines and Resources Canada 1985). Also, some assessment of the effects of CHIP and COSP on rental housing, which accounts for approximately one-third of the housing stock, is needed. These are all aspects that are relevant in a policy sense but could not be analyzed with the HIFE data.

This analysis has revealed some shortcomings of the CHIP and COSP programmes. The differential response to the programmes, often in the same province, reveals that the two programmes should have been better integrated. The required size of a heating system, for example, is determined largely by the thermal efficiency of the home. One is dependent on the other, and programmes that address the issues separately will not succeed as one cohesive project would.

Based on their lower level of retrofitting activity and tendency to live in older dwellings in need of improvements, elderly homeowners, it has been argued, require special attention in any information and incentive scheme. The general success of the dwelling characteristic variables shows that many households, especially those living in newer dwellings, questioned the necessity of retrofitting improvements. Future conservation initiatives should emphasize that *any* home can be upgraded. An R-2000 home, a new generation of high-technology dwelling that is remarkably thermally efficient but well ventilated, could be portrayed as the ideal. Homeowners could be shown how energy-wasteful their dwellings are in comparison. This analysis has shown that people of all socio-economic groups are receptive to any idea when saving money is possible. Such campaigns should concentrate heavily on the money-saving aspect of retrofitting and the associated pay-back periods.

Clearly, there are limitations in the types of variables that can be used in this analysis. Much of the variance in the retrofitting decision is not related to socio-economic or dwelling characteristic factors but rather is associated with individual attitudes, beliefs, and character traits. If this is the case, a more "personalized" data set is needed to assess the role of such variables on retrofitting behaviour. It may be that retrofitters are a more rational, systematic group as a whole than non-retrofitters. Non-retrofitters are perhaps more likely to be described on the basis of the "attitudinal" types of variables. A model that incorporated these types of variables would likely shed more light on the decision-making process. Homeowners who, for example, systematically ignore government initiatives or are negligent in the upkeep of their dwellings might be better understood.

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