

**A Comparison of Demand Patterns of Canadian-Born Versus Immigrant-Born
Consumers¹**

by

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1 Introduction

In studies of demand behaviour, even those which use microdata, there is often very little modelling of differences in spending patterns based on consumers' countries of origin. For example, in Jorgenson, Lau and Stoker (1982) and Nicol (1989), potential differences in spending patterns of these two groups were captured by fixed-effect dummy variables. One of the reasons for this treatment is that there are many household characteristics which affect consumer behaviour, and one is limited by sample sizes as to which of these can be modelled adequately. This is true even when microdata are being used.

Jorgenson, Lau and Stoker (1982) and Nicol (1989) found evidence that country of origin is an important determinant of demand using the limited method described above. However, some more recent research, Nakamura, Nakamura, Nicol and Diewert (1997), suggests that fixed-effect dummy variables are not sufficient to capture all the differences in spending behaviour of immigrant versus Canadian-born consumers. Their research relied on cross-tabulations of spending shares for a variety of goods and services, based on several Canadian Family Expenditure (FAMEX) Surveys.

It therefore seems to be worthwhile to explore the issue of whether the demand model which characterises behaviour of these two classes of consumers is fundamentally different. The purpose of this paper is to explore this question. To orient the discussion, however, some results based on the Nakamura et. al. research will also be presented.

With respect to demand system specification, there are many dimensions in which demand models can be different. Recent research has focused on the rank of demand systems (Blundell, Pashardes and Weber, 1993; Banks, Blundell and Lewbel, 1994; and Nicol, 1995a,b); the importance of labour force participation effects on demand behaviour (Browning and Meghir, 1991; and Nicol and Nakamura, 1994); as well as the extensive literature on incorporating household characteristics effects into demand models (see Browning, 1992, for example for a survey which deals with modelling the effects of children on demand behaviour). In a comparison of spending behaviour between immigrants and Canadian-born based on cross-tabulations, it is not possible to control for all of

the foregoing influences simultaneously. This paper therefore seeks to extend the work in Nakamura, et. al. by comparing demand patterns of immigrant versus Canadian-born consumers on the basis of a well-specified demand model.

It is found that the parameters of the same demand model, for immigrant-born versus Canadian-born households, are statistically significantly different. This holds even when households are split into three different housing tenure groups. This indicates that, when observations on households' expenditure patterns are used to estimate a demand system, these different households must be separated into distinct groups. Otherwise, pooling the groups and allowing for differences in demand behaviour by the use of "intercept-shift" dummy variables will yield misleading estimated parameters. This has the implication that much applied demand research might have to be re-interpreted. In addition, the use of such (incorrect) estimated parameters to estimate elasticities, equivalence scales, measures of inequality, and other policy-oriented magnitudes could also be seriously misleading. Research into this is ongoing.

The remainder of the paper is structured as follows. In Section 2, the data to be used are discussed, and comparisons of cross-tabulations of spending shares for Canadian-born (CN) and immigrant-born (IM) households are presented. These results are based on data from the 1969, 1982 and 1992 Canadian Family Expenditure Surveys (FAMEX), some of which appeared in Nakamura et. al. In Section 3, the demand model specification is discussed, and results of estimation presented. These estimates are used to test for significant differences in spending patterns for the Canadian-born and immigrant-born households. Section 4 summarises and concludes.

2 Spending Pattern Differences by Household Characteristics

2.1 Introduction

This analysis is based on the 1969, 1982 and 1992 FAMEX public-use data. These data were gathered in 1970, 1983 and 1993, for the indicated calendar years, and cover 15,140, 10,938 and 9,492 households, respectively. Since the basic "unit" of coverage in the FAMEX is a household, a determination of how to classify these according to Canadian-born (CN) or immigrant-born (IM)

status must first be made. Nakamura et. al. focus on married-couple households, with varying numbers of children. IM status is thus determined on the basis of the adults in the households. A household is classified as CN if both adult members in the “married couple” have this characteristic. Otherwise, the household is classified as IM.

When analysing differences in spending patterns using microdata, several variables have been found to be important in the applied demand literature. These are housing tenure status; household size; age of head; and labour force participation. Initial cross-tabulations of CN versus IM spending patterns are thus provided across these dimensions.

Housing tenure is combined with family size as a classifying variable for some comparisons. Thus, home-owners, with (MOR) or without mortgages (NMOR), and home renters (REN) are cross-classified as married couples without children (MOR0, for example); married couples with one child (MOR1, for example); married couples with two children (MOR2, for example); and married couples with more than two children (MOR34, for example).

Comparisons based on labour force participation are distinguished as belonging to one of four labour force participation régimes. That is: both adults working outside the home (1,1); male adult only working outside the home (1,0); female adult only working outside the home (0,1); and neither adult working outside the home (0,0).

Households are also classified to two age-of-head of household category. Age of head 15–44 (A1); and age of head 45–65 (A2).

The expenditure categories considered are: clothing (WC); reading (WD); education (WE); food (WF); household furnishings (WH); household operation (WO); water, fuel and electricity (WP); recreation (WR); shelter (WS); private transportation (WT); personal care (WU); alcohol and tobacco products (WV); and total expenditures (TEXP). Each of these categories is defined in Appendix A, for each of the FAMEX survey years. A breakdown of the numbers of households in each of the various tenure status and household size categories is also given in the Appendix. Budget-shares for each expenditure category were calculated by deflating spending on each category of goods by TEXP.

2.2 Cross-Tabulations Based on Housing Tenure and Family Size

Spending patterns were compared for all of the MOR0–MOR34; NMOR0–NMOR34; and REN0–REN34 households. Cell sizes for some of these comparisons (REN and NMOR in particular) were sometimes small (less than ten IM households in some cases). Consequently, only the separate MOR0–MOR34 comparisons are provided, based on the 1992 FAMEX data, as representative of the broad nature of these results. These comparisons are given in Tables 2.1–2.4. In two out of four of these IM households exhibit statistically significantly higher TEXP spending. For specific expenditure categories, the most systematic patterns emerging across the four household types are higher spending on shelter (WS) and education (WE) by IM; and higher spending on recreation (WR), personal care (WU) and alcohol and tobacco (WV) for CN. These results are borne out when comparing MOR households of all sizes, in Table 2.5. This would appear to indicate that, within the IM household group, differences in spending across family size follows similar patterns, but that these patterns are systematically different when compared with CN households.

When comparing NMOR and REN households of all sizes, presented in Tables 2.6 and 2.7 respectively, it is seen that IM households continue to spend larger shares on shelter (WS), and the CN households on recreation (WR). This result seems to be robust across housing tenure status. TEXP also continues to be statistically significantly higher for NMOR IM households, but not for REN IM households.

A comparison of CN and IM household spending patterns across all types of housing tenure and family sizes together is presented in Table 2.8. This confirms the earlier results for the sub-groups, discussed above. That is, statistically significantly higher TEXP by the IM households, with higher shares being spent on education (WE) and shelter (WS). The CN households have higher spending shares on water, fuel and electricity (WFE); recreation, personal care services and supplies (WU); and alcohol and tobacco (WV).

To summarise, IM home-owners spend statistically significantly higher total amounts than do CN. This is concentrated in additional spending on shelter. Furthermore, even for REN households,

shelter spending is statistically significantly higher by IM households than by CN households. One other result which comes through across all tenure groups is that the CN households spend relatively more on alcohol and tobacco (WV). However, it is still appropriate to view family size as an important variable influencing spending patterns. This is emphasised by these results, in that the Table 2.5 results for all MOR households indicates statistically significantly different spending in all categories indicated in the individual family size tables (2.1–2.4), but sub-group family sizes exhibit fewer differences than exist for MOR households as a whole. This is a point which will be returned to in Section 3, where demand system estimation is considered.

Tables 2.8–2.10 provide a comparisons between CN and IM households, for all MOR, NMOR and REN households together, based on observations drawn from the 1982 FAMEX. There are eight statistically significant differences in the proportions spent out of the twelve goods considered, for MOR households. Also, the IM households exhibit statistically significantly higher TEXTP spending. The IM households also have higher spending on education (WE) and shelter (WS). These results are identical to those for the 1992 data. CN households, on the other hand, have statistically significantly higher spending proportions on clothing (WC); household furnishings (WH); water, fuel and electricity (WP); private transportation (WT); personal care services and supplies (WU); and alcohol/tobacco (WV). Thus, there are more differences in spending patterns by MOR households in 1982 than in 1992, although the differences in 1992 are almost a subset of those in 1982. Certainly, as far as IM household spending being higher on TEXTP and certain items, the results are identical to 1992.

The NMOR results are given in Table 2.9. Here again there is statistically significantly higher TEXTP and shelter (WS) spending by the IM households. Again, this is the same as was seen in the 1992 data for the corresponding group. However, there are some additional differences in 1982, and these relate to higher spending on proportions of a wider range of goods by the CN households in 1982. These categories are clothing (WC); household operation (WO); water, fuel and electricity (WP); private transportation (WT); and alcohol/tobacco (WV). Most of these categories coincide with those seen for the MOR household group in the 1982 data. The most notable difference

between the MOR/NMOR results in 1982 compared to the 1992 data is that, in 1982, we do not see the statistically significant difference in the proportion of spending on recreation (WR), as was the case for the 1992 results.

The comparison for the REN households indicates that, as in 1992, we do *not* see a statistically significant difference in TEXP spending between CN and IM households. However, as in 1992, the IM households spend a higher proportion on shelter (WS), and in 1982, on education (WE). The CN households spend higher proportions on water, fuel and electricity (WP); recreation (WR); private transportation (WT); and alcohol/tobacco (WC). Consequently, CN and IM renter households exhibit similar differences in 1982 to those observed in 1992, but in general, there are more CN/IM differences in the REN group in 1982. This is the same qualitative result as was seen for the MOR and NMOR households, discussed above for 1992.

The final comparisons in this sub-section is for all MOR, NMOR and REN CN versus IM households are presented in Tables 2.12–2.14. There are six statistically significant differences in spending shares for the MOR households, although no such difference in TEXP spending, as indicated in Table 2.12. IM households again have higher spending proportions on shelter (WS), and household furnishings (WH). This latter difference is a reversal of what was observed for households in the 1982 FAMEX. CN households spend higher proportions on clothing (WC); household operation (WO); water, fuel and electricity (WP); and recreation (WR). Altogether, for this group, there are *less* statistically significant differences in spending proportions than in the 1982 data (eight), and the 1992 data (seven). The main common findings across all three survey years, however, is the patterns of spending proportions on shelter (WS); water, fuel and electricity (WP); and private transportation (WT). The comparisons for the NMOR households are given in Table 2.13. IM households again have statistically significantly higher spending on shelter (WS); and reading (WD). In addition, as in many other cases, IM households have statistically significantly higher TEXP spending. CN households have statistically significantly higher spending proportions on clothing (WC); food (WF); household operation (WO); and private transportation (WT). These patterns are similar to what was observed for the 1982 sample of households.

Finally, a comparison of the REN households is contained in Table 2.14. This table exhibits the largest differences in CN versus IM household spending patterns of all tenure strata in the 1969 data. That is, there are ten statistically significant differences in spending proportions, and TEXP spending is statistically significantly higher for IM households. As observed previously, IM households exhibit higher spending proportions for reading (WD); education (WE); and shelter (WS). CN households, on the other hand, exhibit statistically significantly higher spending on clothing (WC); food (WF); water, fuel and electricity (WP); recreation (WR); private transportation (WT); personal care (WU); and alcohol/tobacco (WV). These results for the 1969 FAMEX REN households are therefore very much like many results observed for other years, and dimensions of comparison. For all three survey years, however, it should be borne in mind that the *combined* set of spending differences is wider (for a specific housing tenure status group) when all family sizes are included, than when only one sub-group family size is considered. This has important implications for demand system estimation, and will be returned to in Section 3.

2.3 Cross-Tabulations Based on Labour Force Participation Status

In this sub-section, we compare spending patterns between CN and IM households by employment status of the adult household members. Table 3.1 provides a breakdown of the numbers of households in each of the categories defined earlier, (1,1)–(0,0). Comparisons for each of the labour force participation strata, (1,1)–(0,0), are given in Tables 3.2–3.5 respectively.

In Table 3.2, where both adults in the CN and IM households work outside the home, (1,1), it is seen that the IM households exhibit statistically significantly higher TEXP spending. These households also spend higher proportions on education (WE) and shelter (WS), which is something seen above, in Sub-section 2.1. Also, CN households spend statistically significantly more on water, fuel and electricity (WP); recreation (WR); and alcohol/tobacco (WV).

Exactly the same pattern as in Table 3.2 is repeated in Table 3.3, which is the comparison for households where only the male adult works outside the home, with the exception of *statistically significantly* higher TEXP spending. Consequently, the IM household groups (1,1) and (1,0) have

similar spending patterns relative to the corresponding CN household group.

For the household group where only the female adult works outside the home, (0,1), Table 3.4 indicates that there are no statistically significantly different spending patterns between such CN versus IM households. One might expect that this is related to these types of households being relatively lower income households. However, there are statistically significantly different spending patterns between CN and IM households with low incomes (see Nakamura et./ al. for details).

Finally, the comparison between households in the (0,0) group is given in Table 3.5. Here it is seen that IM households spend a larger proportion of TEXP on shelter. CN households spend statistically significantly higher proportions on water, fuel and electricity (WP); recreation (WR); personal care (WU); and alcohol/tobacco (WV).

To summarise, the main differences in spending patterns are similar in type for the employment status groups, (1,1), (1,0) and (0,0). The (0,1) group, on the other hand, do not exhibit significant differences in spending patterns.

Corresponding results to those presented above based on the 1992 FAMEX were also computed for households surveyed in the 1982 FAMEX. These results are presented in Tables 3.7–3.10. A breakdown of the numbers of CN and IM households in each of the (1,1)–(0,0) strata are provided in Table 3.6.

The both-adults-working category results, (1,1), are presented in Table 3.7. It can be seen that IM households exhibit statistically significantly higher TEXP spending, as was the case for the 1992 data. This higher spending is concentrated again in the education (WE) and shelter (WS) categories, as with the 1992 sample. In addition, IM households have higher spending on food (WF) for this labour force participation stratum. CN households exhibit statistically significantly higher spending on clothing (WC); private transportation (WT); personal care (WU); and alcohol/tobacco (WV). Consequently, differences in spending patterns for this group in 1982 are similar to those reported above for the 1992 sample. In particular, the TEXP spending; education (WE); shelter (WS); and alcohol/tobacco (WV) spending proportions follow the same patterns in 1982 and 1992.

The male adult only working outside the home category, (1,0), results are reported in Table 3.8.

These results are similar to the (1,1) results above. IM households have statistically significantly higher TEXP spending, and also spend higher proportions on education (WE) and shelter (WS). CN households spend statistically significantly higher proportions on clothing (WC); water, fuel and electricity (WP); private transportation (WT); and alcohol/tobacco (WV). The only major difference here from the corresponding 1992 results is the higher TEXP spending, which was not statistically significantly different for that sample.

In the 1992 FAMEX comparison for the (0,1) group (female adult only working outside the home), there were no statistically significant differences in spending patterns between the CN and IM households. The corresponding results for the 1982 FAMEX are given in Table 3.9. Here, there are some statistically significant differences in spending proportions, but these are less in number than the 1982 (1,1) and (1,0) differences. CN households have higher spending on clothing (WC); water, fuel and electricity (WP); and alcohol/tobacco (WV). These results are qualitatively similar to those for 1992 in that there are less significant differences for this group, relative to the (1,1) and (1,0) groups.

The final comparison in this sub-section is in Table 3.10, for the (0,0) (neither adult working outside the home) group. Here the only difference is a statistically significantly higher spending proportion on clothing (WC) for the CN households. Therefore, in the 1982 data, the differences are greatest for the (1,1) group, and these differences decline monotonically as we move from (1,1), (1,0), (0,1) to (0,0). In the 1992 FAMEX, however, there are more differences in spending patterns for the (0,0) household group.

Table 3.11 gives a breakdown of the numbers of households in each of the (1,1)–(0,0) employment participation strata drawn from the 1969 FAMEX. Tables 3.12–3.15 give the results of comparing spending patterns for the four labour force participation strata, (1,1)–(0,0), referred to previously. The both adults working, (1,1), category comparison, in Table 3.12, indicates statistically significantly higher TEXP spending by IM households. This was observed in the 1992 and 1982 comparisons. IM households also exhibit statistically significantly higher household furnishing (WH) and shelter (WS) spending proportions for this group. CN households have statistically

significantly higher spending proportions on clothing (WC); household operation (WO); water, fuel and electricity (WP); private transportation (WT); and alcohol/tobacco (WV). These differences are similar to those seen for the (1,1) group in the other two FAMEX surveys.

Table 3.13 gives the comparisons for the (1,0), male adult only working, group. Again, IM households have statistically significantly higher TEXP spending. Furthermore, *all* categories of expenditures show statistically significant differences in spending proportions between CN and IM households. Spending proportions are higher for the IM households for reading (WD); household furnishings (WH); and shelter (WS). However, unlike other comparisons, CN households for this group have higher spending proportions on education (WE). This is the most notable difference, relative to others considered in this paper so far.

The female adult only working, (0,1), comparison is given in Table 3.14. IM households have statistically significantly higher TEXP spending, which was not observed for the 1992 or 1982 households. The number of statistically significant differences in spending proportions here is three, which is similar to other years in being low compared to some of the other employment status groups.

The final comparison is for the neither adult working, (0,0), group, given in Table 3.15. As with the 1982 FAMEX, there is only one statistically significant difference in spending proportions (although here for a different category than in 1982).

The labour-force participation comparisons for the three FAMEX survey years can be summarised as follows. IM households in the (1,1) group (both adults working outside the home) exhibited statistically significantly higher TEXP spending, and higher spending on education (WE) and shelter (WS). This was true for all survey years. CN households for the (1,1) group, on the other hand, had higher spending on clothing (WC), private transportation (WT), personal care services and supplies (WU) and alcohol/tobacco (WV).

For the (1,0) labour participation group (male only working outside the home), IM households again showed higher TEXP and shelter (WS) spending for 1969 and 1982, and higher education (WE) spending in all three years. CN households, on the other hand, showed higher spending in

water, fuel and electricity (WP) and alcohol/tobacco (WV).

For the (0,1) and (0,0) groups, cell sizes were sometimes quite small, so it is difficult to interpret some of these results. However, differences which were significant were for IM spending on shelter (WS) and CN households spending on tobacco/alcohol (WV) and water, fuel and electricity (WP).

2.4 Cross-Tabulations Based on Age of Head of Household

In this sub-section, the households are split into groups with age of head 15–44 (A1); and those with age of head 45–65 (A2). Table 4.1 gives the comparison of the A1 households. Again, we see that the IM households spend statistically significantly higher proportions on education (WE) and shelter (WS). CN households spend higher proportions on water, fuel and electricity (WP); recreation (WR); and alcohol/tobacco (WV). There is not a statistically significant difference in TEXP spending for A1 CN and IM households, however.

Table 4.2 gives the comparison between A2 households. Here, the IM households do have statistically significantly higher TEXP spending. Also, as before the IM households spend higher proportions on education (WE) and shelter (WS). The CN households spend higher proportions on water, fuel and electricity (WP); recreation (WR); personal care (WU); and alcohol/tobacco (WV).

Tables 4.3–4.4 contain the results of spending comparisons for CN and IM households by age in 1982. Table 4.3 provides the comparison for households with age of head 15–44. There are more statistically significant differences for this group than was seen for the corresponding 1992 sub-sample. In addition, TEXP spending is statistically significantly higher here, unlike the 1992 comparison. This difference is again centered in the education (WE) and shelter (WS) categories. CN households exhibit statistically significantly higher spending proportions on clothing (WC); water, fuel and electricity (WP); private transportation (WT); personal care (WU); and alcohol/tobacco (WV). We see a wider set of differences in spending proportions than for the corresponding comparison in 1992.

The comparison for the age of head 45–65 (A2) group are given in Table 4.4. There are less

differences here than was the case for the 1992 comparison. In particular, there is no statistically significant difference in TEXP spending. However, again there is a statistically significantly higher spending proportion on shelter (WS) for the IM households, as seems to be commonplace throughout these comparisons. CN households exhibit statistically significantly higher spending proportions on clothing (WC); water, fuel and electricity (WP); private transportation (WT); and alcohol/tobacco (WV).

Tables 4.5– 4.6 gives the comparison of spending patterns according to age of head for the 1969 FAMEX. For age of head 15–44 (A1), in Table 4.5, All expenditure categories exhibit statistically significantly higher spending proportions. IM households have statistically significantly higher TEXP spending. This is concentrated in the reading (WD); education (WE); household furnishings (WH); and shelter (WS) categories.

Table 4.6 indicates that there are less spending pattern differences for the age of head 45–65 (A2) household group in 1969, but TEXP spending is still statistically significantly higher for the IM households. This was seen for the 1992 and 1982 FAMEX samples. Again, for the IM households, this higher spending is concentrated in reading (WD); household furnishings (WH); and shelter (WS).

To summarise age of head comparisons of spending by CN and IM households indicate higher TEXP, education (WE) and shelter (WS) spending by IM households; whereas CN households exhibit higher spending on water, fuel and electricity (WP), recreation (WR) (except in 1982) and alcohol/tobacco (WV).

2.5 Conclusion

No matter which dimension one considers for comparisons, whether by housing tenure, employment status, income level or age, IM households typically have statistically significantly higher TEXP spending, and also spend higher proportions on education (WE) and shelter (WS). The CN, on the other hand, spend higher proportions on water, fuel and electricity (WP); recreation (WR); and alcohol/tobacco (WV). For some comparisons, in some dimensions, there are sometimes

additional differences, but the ones indicated here are the most pervasive.

3 Demand System Estimation and Results

In earlier research (Nicol 1995a,b), Canadian and United States microdata were used to explore a variety of model specification issues in applied demand analysis. The latter paper used a unique set of price data which made it possible to utilise the United States Consumer Expenditure Surveys (CES) from 1980–1992, in a way comparable to that in which the Canadian Family Expenditure Surveys (FAMEX) have been used in a variety of studies, including Nicol (1995a).

Some common themes emerging from those papers were the findings that labour force participation variables, age of head, and a number of other variables are important determinants of demand. It was also found that it did not seem to be crucial to model the demand equations as coming from a rank three system. This was perhaps attributable to the use of homogeneous household groups to estimate the demand systems. That is, some earlier research by Lewbel (1989) appeared to indicate that rank two modelling of demands was sufficient, when the data being used pertained to homogeneous household groups.

In the above research, differences in spending between CN and IM households were modelled by, at most, intercept-shift dummy variables. The results in Section 2 above seem to indicate that this might not be adequate: that there are greater differences in demand model parameters than can be captured by mere intercept-shift dummy variables.

The data on households in the 1969, 1982 and 1992 FAMEX used in the analysis of the previous section were combined, and a demand system estimated for sub-groups of tenure status and family size households, further split into CN and IM household sub-groups.

The starting point for model specification was to consider as inclusive a specification as possible, based on earlier research. That is, age of head, labour force participation and rank three aspects were modelled. However, since the data are from only three FAMEX surveys, price parameters are not empirically identified (due to limited variability in prices), so Engel functions were estimated.

The starting point for the demand model specification is the quadratic logarithmic family of

cost function of Fry and Pashardes (1992),

$$\ln C_h(u_{ht}, p_t) = a_h(p_t) + b_h(p_t)/[f_h(u_{ht}) - g_h(p_t)] \quad (1)$$

where h indexes households, and $a_h(p_t)$, $b_h(p_t)$ and $g_h(p_t)$ are price indices (the first, homogeneous of degree one, and the last two, homogeneous of degree zero).

The Marshallian budget-share functions for this model are given by

$$w_{iht} = a_{ih}(p_t) + [b_{ih}(p_t)/b_h(p_t)][\ln y_{ht} - a_h(p_t)] + [g_{iht}(p_t)/b_h(p_t)][\ln y_{ht} - a_h(p_t)]^2 \quad (2)$$

given the following specifications for the price indices

$$a_h(p_t) = \alpha_{0h} + \sum_j \alpha_{jh} \ln p_{jt} + \frac{q}{2} \sum_j \sum_k \gamma_{jk} \ln p_{jt} \ln p_{kt} \quad (3)$$

$$b_h(p_t) = \beta_{0h} \prod_j p_{jt}^{\beta_{jh}} \quad (4)$$

$$g_h(p_t) = b_h(p_t) \lambda_h(p_t) \quad (5)$$

$$\lambda_h(p_t) = \lambda_{0h} + \sum_j \lambda_{jh} \ln p_{jt} \quad (6)$$

The parameters, α_{ih} , α_{0h} , β_{ih} , λ_{0h} and λ_{ih} are household-dependent. That is, they are functions of the household characteristics variables, age of head and labour force participation status of the adult household members.

Since the price parameters are not empirically identified (as explained above), the Engel functions can be written as follows

$$w_{ih} = \alpha_{ih} + \beta_{ih} \ln y_h + [\lambda_{ih} + (\beta_{ih} \lambda_{0h})][\ln y]^2 \quad (7)$$

Assuming a stochastic disturbance term, ϵ_{ih} , enters each equation, such that $\epsilon_i \sim N[0, \Omega_i]$, where $\Omega_i = \text{diag}[\sigma_{hi}]$, (7) can be estimated. As usual, since the budget-shares in the system add up to unity, the covariance matrix of the disturbances is singular, so the system can be estimated by dropping one of the n equations, and the parameters of the remaining equation recovered by the adding up conditions.

It will be noted from the above discussion that the disturbances are assumed heteroskedastic across households. Thus, the estimation procedure allows for heteroskedastic-consistent estimation of the variance-covariance matrix of the estimators, conditional on heteroskedasticity of unknown form. Furthermore, it is often felt that $\ln y$, as well as any labour force participation variables in the system, might not be exogenous. Consequently, the estimation procedure takes this into account, and a generalised method of moments (GMM) procedure is used. This procedure iterates on the estimated variance-covariance matrix of the system, as well as other parameters, to ensure invariance of the estimated parameters to the equation dropped. This is necessary when estimating a singular system of the type presented here.

As a first step in exploring whether demand parameters are systematically different across CN versus IM households, (7) was estimated for selected household groups, which were relatively the largest of those discussed in Section 2. These household groups were CN and IM households in the MOR2, NMOR0 and REN0 categories. The system was estimated separately for the sub-group CN and IM households yielding estimated parameter vectors, $\hat{\beta}_c$ and $\hat{\beta}_i$ respectively. If the respective estimated variance-covariance matrices of these vectors are denoted as $V[\hat{\beta}_c] = \hat{\Sigma}_c$ and $V[\hat{\beta}_i] = \hat{\Sigma}_i$, then the statistic $W = [\hat{\beta}_c - \hat{\beta}_i]^T [\hat{\Sigma}_c + \hat{\Sigma}_i]^{-1} [\hat{\beta}_c - \hat{\beta}_i] \overset{A}{\sim} \chi^2(q)$, where q is the number of parameters in the demand system. W can be used to test the null hypothesis that $\hat{\beta}_c$ and $\hat{\beta}_i$ are not statistically significantly different.

The estimation results for the MOR2, NMOR0 and REN0 data sets indicated that the age of head and labour force participation variables were statistically significant determinants of demand, for both CN and IM households. The inclusion of quadratic terms for $\ln y$, however, were not always necessary. That is, these terms were not statistically significant for the CN households with the NMOR0 data set; nor for the IM households with the REN0 data set.

Wald Principle based tests for differences in parameter estimates across CN and IM households using the W statistic presented above indicated that the nul hypothesis was strongly rejected. The values of the test statistics for MOR2, NMOR0 and REN0 were 68.106, 51.590 and 128.384 respectively. The number of estimated parameters in each case was twenty, so that $q = 20$, the

degrees of freedom of the tests. The critical value of a $\chi^2[20]$ at an α -level of 0.001 is 45.3. Consequently, the null hypothesis is strongly rejected for all data sets considered.

4 Summary and Conclusions

In this paper, three FAMEX surveys for 1969, 1982 and 1992 were used to study whether significant differences exist in the spending patterns of Canadian-born (CN) versus immigrant-born (IM) households. The results indicate that this is indeed the case, with IM households exhibiting statistically significantly higher spending in total, as well as on shelter and education. CN households, on the other hand, exhibited statistically significantly higher spending on water, fuel and electricity (WP), recreation (WR) and alcohol/tobacco (WV). These differences came out strongly whether households were grouped according to housing tenure status, labour force participation status of adult members, or age of head.

Given the important differences detected in the foregoing cross-tabulations, a further analysis was conducted, to determine whether the differences meant that the CN and IM households should be grouped separately for the purposes of demand system estimation. A general model of demand was estimated incorporating housing tenure status, family size, labour force participation status and age of head variables. This model was estimated separately for CN and IM household groups. It was found that, indeed, the parameters of the demand models for these two groups were statistically significantly different. This is an important finding, since demand studies, if they model immigrant status of households at all, do so only via intercept-shift-type dummy variables. The results presented here thus imply that the results of demand studies ignoring immigrant household status effects perhaps need to be re-interpreted.

There are many directions in which this research can be developed. While parameter estimates for the CN and IM groups are statistically significantly different, this does not *necessarily* translate into such differences for other estimates of interest, such as elasticities, equivalence scales, and estimates of inequality, which are sometimes based on models of demand. However, analyses along these lines would seem to be warranted. In addition, by making use of additional FAMEX surveys,

a demand system with price effects could be estimated, and parameters of CN and IM households compared in such a context. These research directions are ongoing.

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