EXPENDITURES ON HOUSING MAINTENANCE AND REPAIRS:
SOME RECENT EVIDENCE.

An Analysis of Expenditures made by

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Summary

Government housing rehabilitation programs are partly responses to the existence of deteriorated housing. Such housing is a result of decisions made in the private market. Apart from simply observing the outcome of such decisions we know little about the overall process of private investment in the older housing stock as it occurs in Canadian cities.

This study is a preliminary exploration of housing maintenance and repair decisions made by owner occupiers in the Toronto area in 1973. The data are analysed partly to sketch in some basic features of the repair and process and secondly to show the possibilities for future research in this important area of housing activity. A number of substantive patterns are analysed with several relevant findings.

The study reveals that maintenance and repairs made up over one third of the value of new construction in Toronto in 1973. At the same time most home owners do not make repairs in any one year and of those that do, over half spend under 500 dollars. In fact, 12 percent of owners who made repairs account for 50 percent of the value of all repairs made.

The highest annual repair expenditures were made by younger owners, those with higher incomes and those who have purchased their dwelling most recently. In general, it is the older as well as lower valued stock which is more likely to receive at least some expenditure but not necessarily the highest amounts. Higher valued properties tend to receive the higher lump sum expenditures. Consistently, single detached properties attract relatively high investment. Thus the results tell us who is investing in the existing stock, and in what amounts and it also indicates which types of properties are receiving this investment.

While this is as far as this particular study goes, the potential research possibilities are much broader. There are good reasons to pause after a preliminary examination such as this and begin to prepare for the
application of more sophisticated analysis of these Toronto data and perhaps to extend the study to other cities in Ontario and Canada. At the same time it is relevant to note a number of deficiencies in the data and to plan for more appropriate questions in the second phase of the longitudinal Survey of Housing Units in Canada. At present while such a survey offers a unique opportunity to study the propensity to invest in repairs over a period of several years this opportunity is being forgone through the omission of two critical survey questions.
INTRODUCTION *

The conservation of the existing housing stock is often addressed in terms of government participation in the housing sector (Canadian Council for Social Development, 1975). However, as the authors of one recent study observed; "for the most part the housing conservation process is a private sector activity undertaken by individual householders or landlords, either on a regular basis as part of home maintenance, or less frequently, as part of more expensive home repairs and renovations." (Klein and Sears, 1975:73)

Government programs are directed towards the rehabilitation of those residential properties which have been or are likely to be neglected by the private market. In general these programs are based on certain assumptions as to who in the private sector makes maintenance and repair expenditures, in what kinds of properties and under what environmental and market conditions. To date the exact nature of these assumptions has not been specified.

One of the reasons why these assumptions have not been specified is the paucity of empirical evidence on patterns of expenditure in the private sector. Hitherto, available information has been confined to three sources: case studies of a subset of the population in particular residential areas (e.g. Rose, 1964), aggregate statistics at the municipal, provincial and national levels (e.g. Statistics Canada, Cat 62-201) and, data collected by governments on part of program delivery. ¹

Although there now exist several evaluations of government rehabilitation programs (Rostum 1977, 1978 and P. Barnard Assoc., 1977) comparable attention has not been paid to the much larger investment made by the private sector. There is as yet no study in Canada which has examined expenditure on the existing housing stock in light of characteristics of both investors and the recipient residential properties.

The aim of this study is to evaluate the Survey of Housing Units carried out by Statistics Canada for the Central Mortgage and Housing Corporation (SHU, '74)
as a base upon which a more detailed and sophisticated study of annual investment by home owners in their properties may be prepared in the future. The first section of the paper examines the relevant question asked in the Survey and the problems of interpretation it raises. Aggregate data on expenditure on maintenance and repair by homeowners in the Toronto survey area is presented and compared with other available evidence. The data on repair expenditure is then examined by attributes of the home owner and by characteristics of the property. The analysis of who makes repair expenditures focuses on the recency of purchase, the age and income of the owner. Where expenditures are made is examined in terms of the age, value and type of residential property. Implications of these results are discussed and a number of issues regarding future work are raised.

THE S.H.U. SURVEY DATA AND INTERPRETATION

The SHU survey was carried out by Statistics Canada between 30th September and 6th December, 1974. Among the questions asked was the following, directed at owner occupants:

"Did this household spend any money on repairs and maintenance for this dwelling in 1973?"

"If yes, how much?"

(Question C33, Statistics Canada, 1976) Respondents were given as examples: "new roofing, new windows, painting, etc." There are two responses to question C33: yes, no or don't know in the case of the first part, and a dollar value in the case of those who answered 'yes' to the first part. It is these two responses, their substantive meaning and statistical distribution which is the focus of this inquiry.

The primary purpose of question C33 in the original survey was simply to help estimate total dollar expenditure on housing in a given year by a household. The aim was to use these figures to compute a more accurate figure of housing
expenditure. If this is the sole interest in the responses to question C33, then the answers given may be taken at face value. It is a premise of this study however that there are other equally useful applications for these same responses.

The danger in using data for purposes other than that for which they were intended lies in inferring more than the question was originally designed to elicit. The central question of interest in this study concerns the relationship between the amount of money reported as being spent on maintenance and repair expenditure and the actual value of improvements made. The inferential issue arises from the fact that only under specific assumptions (outlined below) will the sum of dollars spent on repairs be an unbiased estimate of the value of improvements made.

Knowing the value of improvements is important for making judgements on whether such expenditure is sufficient to maintain the dwelling unit at its existing quality level. Failure to make the appropriate level of expenditure results in deterioration, and, in the absence of subsequent private market investment, an eventual need for rehabilitation. In particular, information on private repair expenditure may help in evaluating the relative need for government attention to preventative housing programs, those geared to arresting deterioration before the property falls below 'community housing standards'.

From Dollars of Expenditure on Repair to Value of Improvements

The response to question C33 may be decomposed as follows

\[ \hat{R} = K + L_d \]

where \( \hat{R} \) is the sum of dollars devoted to repairs during 1973 as estimated by the home owner, \( K \) is the dollar value of materials, and \( L_d \) is the dollar value of paid labour.

By contrast the estimated value of repairs as might be estimated by a building inspector or appraiser is likely to be

\[ \hat{V} = K + L_d + L_u \]
where $L_u$ is the dollar value of repairs contributed by unpaid labour such as that provided by the family or friends.  

The sum of dollars devoted to repair as estimated by respondents to question C33 will differ from an estimate of value by the value of total work performed by unpaid labour:

\[(3) \quad \hat{V} - \hat{R} = L_u \quad \text{and hence} \quad \hat{V} = \hat{R} + L_u\]

Thus if we wish to use $\hat{R}$ to estimate $\hat{V}$ then empirical evidence on the variation in $L_u$ over key explanatory variables must be assembled.

The Use of Paid and Unpaid Labour for Home Improvements

Only very rough indications of the data necessary to estimate $L_u$ are available. In the first instance there are the valuable but purely descriptive accounts of the use of unpaid labour by characteristic of owner and neighbourhood, as given for example in Krohn et al (1977).

More consistent quantitative evidence from Canadian sources is only available in a partial form. Nevertheless it is useful in this exploratory study to start with specific relationships which are already available, in this case with that between use of unpaid labour $L_u$ and income of the owner household. The question on repairs asked in the Urban Family Expenditure Survey (UFES) may be used to cast some light on this question.

Respondents in the UFES survey were asked to, a) state whether repairs had been carried out in the last year, b) whether costs of material were incurred, and c) whether contractors were used. The results presented by Statistics Canada are in terms of the percentages of total respondents in each income class who responded positively to each question.

It seems reasonable to assume that material costs are only likely to be mentioned where such costs are incurred separately from costs of paid labour, and that this will be the case where family or other unpaid labour is used in the
production of repairs. By contrast in contract jobs, payments made refer to the sum of materials and paid labour. The results of the UFES questions allow the probability, $p$, that the repairing household will incur paid labour costs to be expressed as a function ($f$) of family household income ($y$).

$$p(L_d) = f(y)$$

If it can be assumed that $K$ is a constant proportion of $V$ over the domain $y$, then, for each income category

$$1 - p(L_d) = p(L_u).$$

Such an interpretation of equation (4) only holds if households in fact select either material costs (and unpaid labour) or contract labour. However, it does not seem unreasonable that in the space of one year, the majority of repairs would be done by one or the other and that the assumption of $L_d$ and $L_u$ as exclusive events will hold.

Empirical Evidence

With the above concepts in mind, the results of the UFES survey as presented in Figure 1 suggest that, as family income increases, unpaid labour is substituted for contract labour at different rates over the income domain. The marginal rate of substitution of paid for unpaid labour (the contract costs curve) declines to zero in the income range between $10,000$ and $20,000$, only to rise again at an increasing rate as income increases. Thus the highest probability that paid labour will be used for repairs occurs in the very lowest and in the very highest income classes.

Using income alone hides a composition effect, for the non-linear result in Figure 1 stems from the joint variation of age of head of household with income. The very low incomes are associated with old, largely widowed owner occupiers who are unable, relatively speaking, to call on unpaid labour and are more likely to hire outside contractors to perform repairs - (a fact, which also make them less likely to carry out non-essential repairs).
FIGURE 1

USE OF CONTRACTORS BY HOME OWNERS FOR REPAIRS BY INCOME OF
FAMILY. EIGHT CITIES, CANADA, 1972.

Source: Statistics Canada, Cat 62-541, Occasional, 1972, Table 21, p 78-79.
As a larger number of younger households with their relatively higher income appear in the sample, the opportunity to call on family labour increases. This characteristic of young households has been documented on a number of occasions in a variety of settings, for example Kirwin and Martin, (1972) and Krohn et al, (1977). Hence the percentage of costs due to contract labour drop as the middle income groups are approached. After this point larger incomes and the desire for higher quality skilled work combine to raise the percentage of contract labour used.

The foregoing discussion, although hampered by lack of additional data on the pattern of use of unpaid labour, has nevertheless provided some preliminary guidance regarding possible differences between respondents' dollar estimates of costs of repair to them $\hat{r}$ and the more substantively relevant measure, $\hat{v}$, the total value of improvements made. The guidelines suggested for equating the two will at least allow the same rough estimate of the magnitude of bias to be made, that is the degree to which $\hat{r}$ is likely to be an under estimate of $\hat{v}$ with respect to any explanatory variable of interest.

AGGREGATE EVIDENCE FOR THE TORONTO AREA

Expenditures on housing maintenance and repair constitute a surprisingly large proportion of all annual expenditure on housing production. This section considers the magnitude of repair expenditures made as revealed by the SHU survey and compares this with other evidence. These expenditures are then broken down by size categories to reveal a highly skewed distribution of annual expenditures.

The Magnitude of Repair and Maintenance Expenditure

The total expenditure on all dwelling units covered by the SHU survey for the year 1973 as estimated by sampled home owners amounts to an estimated $167,021,267 dollars. This figure compares with nearly 460 million dollars devoted to the construction of all new residential properties in the Metropolitan Toronto area in 1973 (Newby, 1976, Table 1.2). On the basis of these figures
expenditures by home owners on repair to owner occupied properties amounted to a very high 36.3 percent of investment in new construction of all types of housing in the slightly smaller Metropolitan Toronto area (recall footnote 2). This figure is almost double the 18.84 percent estimated for Ontario for repairs and maintenance expenditures on all residential properties as a proportion of all new residential construction in 1973 (Statistics Canada, 64-201, Table 24), and lies outside the upper extreme of 33.06 percent for this same ratio reached in 1961. The figures for Canada as a whole are 19.9 percent in 1973 and the highest percentage is 33.0 also reached in 1961.

The other possible base for comparison is building permits. The figures based on building permits are clearly underestimates; the value of permits taken out for repairs in Canada in 1971 amounted to only 2.62 percent of those taken out for new construction; 1971 is the last year for which repair permits were published separately, (Statistics Canada, 64-203, 1972).

Even allowing for errors in the SHU sample estimate, and the slight difference in the geographical areas covered by the repair and new construction surveys the estimated amount of expenditures does appear to overstate the actual level of repair and maintenance. This is especially apparent when it is recognized that the SHU estimates given here only apply to owner occupiers whereas other evidence also includes expenditures made by absentee landlords and renters themselves.

One of the reasons for this high SHU percentage may be the ambiguity in term 'repairs and maintenance' as this appears in question C33. From the size of some of the expenditures reported below it is clear that a number of so called maintenance and repair expenditures were in fact major alterations.

Repairs as a concept distinct from maintenance or renovation is only relevant from the perspective of the defined needs of the property, not the household. One of the problems with question C33 as asked in this survey is that repairs as such have no clear counterpart in the households concept of this own
actions. There is no need for the average household to consciously consider at any time whether what he is doing to his house are 'maintenance and repairs' or renovations. He is primarily concerned with achieving a certain level of housing and will make whatever expenditures are necessary (within a budget constraint) to achieve that end. Hence it may be too much to expect the respondent to do the complex grouping of all expenditures he makes on his house into a largely unexplained category called maintenance and repairs. Although this ambiguity exists, it cannot be resolved in this study. In order to remain aware of the problems however the expenditures recorded will continue to be called "maintenance and repair" expenditure (or just "repair" for short) with the appropriate quotation marks.

The lack of good comparable data means that the SHU estimates should be treated as simply one of a small possible set of estimates. It is worth noting however that if the SHU figures are the correct figures then other official figures are substantial underestimates. The implication is that expenditure on existing housing may in fact be a lot more important simply in terms of dollars spent than previous figures would suggest.

The Distribution of Expenditures

This survey reveals that "repair" expenditures in any one year are made by a very limited section of the owner occupier population. Of the owner occupiers interviewed in the Toronto survey area in 1974, under half (45.2 percent) actually reported making any expenditures on "maintenance and repairs" in the previous year. This low figure is consistent with other available evidence.12

The distribution of expenditures is described in detail in Table 1, where sample and population estimates are presented for comparison.13 One third (33.0 percent) of those reporting some "repair" expenditure said they spent under $250 and over half (56.9 percent) spent under $500. By contrast, just under one fifth of such respondents invested over $1000. This is clearly a highly skewed
# TABLE 1

## EXPENDITURES ON MAINTENANCE AND REPAIRS BY VALUE CATEGORY.

**OWNER OCCUPIERS. TORONTO, 1973**

<table>
<thead>
<tr>
<th>Value Category (1973 dollars)</th>
<th>Sample Estimates</th>
<th>Population Estimates</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ABSOLUTE FREQ</td>
<td>ADJUSTED FREQ (PCT)</td>
</tr>
<tr>
<td>------------------------------</td>
<td>------------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>$1-$249</td>
<td>198</td>
<td>33.0</td>
</tr>
<tr>
<td>$250-$499</td>
<td>139</td>
<td>23.2</td>
</tr>
<tr>
<td>$500-$749</td>
<td>57</td>
<td>9.5</td>
</tr>
<tr>
<td>$750-$999</td>
<td>91</td>
<td>15.2</td>
</tr>
<tr>
<td>$1000-$1249</td>
<td>12</td>
<td>2.0</td>
</tr>
<tr>
<td>$1250-$1499</td>
<td>25</td>
<td>4.2</td>
</tr>
<tr>
<td>$1500-$1749</td>
<td>3</td>
<td>0.5</td>
</tr>
<tr>
<td>$1750-$1999</td>
<td>21</td>
<td>3.5</td>
</tr>
<tr>
<td>$2000-$2999</td>
<td>18</td>
<td>3.0</td>
</tr>
<tr>
<td>$3000-$3999</td>
<td>16</td>
<td>2.7</td>
</tr>
<tr>
<td>$4000+</td>
<td>20</td>
<td>3.3</td>
</tr>
<tr>
<td>600</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*Note...Due to large or fractional weights, some frequencies may be in error by as much as 10.1%

distribution, with a few owners investing disproportionate amounts in (so called) "maintenance and repair."

There is some evidence to suggest that the distribution given in Table 1 may be bi-modal, the first mode being in the $1-249 category and after an irregular decline to $1749, the numbers rise to the second mode at $1750-$1999. There are a number of possible reasons for such a pattern. These include variations in the gap between condition of the stock at a location and the level of demand for housing quality at that location. A further possibility, as suggested above is missinterpretation of the literal meaning of question C33 and the reporting of major renovations. Lack of reported data on the types of 'repairs' undertaken prevents this hypothesis from being verified.

The character of the skewed distribution of Table 1 may be more clearly indicated through Figure 2 which is also based on those reporting non-zero expenditures. The figure indicates the degree to which the expenditure on "maintenance and repairs" is unevenly dispersed over the sample of owner occupiers. From Figure 2 (guide line A) it can be readily seen for example that 50 percent of all "repair" expenditures in 1973 were made by 12 percent of those owner occupiers who made some expenditures. From another perspective, (guideline B), 50 percent of these owner occupiers together contributed less than 13 percent of all "repair" expenditures in a given year. It is important in light of this distribution to ask who is making the "repairs" and which projects are receiving the investment. This question will now be dealt with through an inspection of the disaggregate evidence.

DISAGGREGATE EVIDENCE

The relationship between the characteristics of owners, the attributes of the property, the probability that repairs will be undertaken and how much will be spent are the subject in the following discussion. In addition, attention will be paid to some conceptual issues associated with length of occupancy, the house as a durable good and the problem of inference from cross sectional data.
FIGURE 2

THE DISTRIBUTION OF HOME OWNERS AND LEVELS OF EXPENDITURE ON MAINTENANCE AND REPAIRS

*Based on the weighted number of households estimates (N).

Source: See Table 1.
As yet we know little, either conceptually or empirically about this issue and for this reason it was considered inappropriate to begin by applying any particular model from economic theory or any particular multivariate statistical model.

Owner Occupant Characteristics and Expenditure on Repairs

In the section to follow three characteristics of the household are analysed with respect to "repair" expenditures: the age of the head of household, income of the household as a whole and length of owner occupancy of the head.

The analysis of the effect of the age of the head of household on "repair" behaviour is based on Table 2. This table is typical in its layout to those that follow. In each table the incidence of expenditure is reported in column 1 with corresponding proportions of non-zero expenditure in column 2. The rest of the typical table will focus solely on the distribution of levels of expenditure over relevant value categories of the explanatory variables.

The first tabulation reveals two central difficulties: the considerable variance in levels of expenditure within any value category of a variable and the fact that the probability and the amount of expenditure varies in a non-linear fashion over the relevant domain. These two features reappear as each new explanatory variable is investigated.

In order to convey the highly variable nature of the data the results have been presented in several different but complementary ways. Perhaps the most instructive is the distribution of levels of expenditure over different values of the explanatory variable (column 5 through 9). In each case an hypothesis will be tested on the raw counts of these crosstabulations. The hypothesis is that values in the table relating explanatory variables and levels of repair expenditure will differ on some criterion from those expected under an assumption of statistical independence. A chi-square statistic will report the result of the test.

Columns 11 through 13 of the typical table present the mean expenditure,
### TABLE 2

**Expeditures on Maintenance and Repair by Age of Head of Household**

**Toronto, 1973**

<table>
<thead>
<tr>
<th>Age of Head (in years)</th>
<th>Frequency in Each Category</th>
<th>Relative Frequency</th>
<th>Proportion Making</th>
<th>Number Making</th>
<th>Expenditure</th>
<th>Proportion Making Specific Levels of Expenditure</th>
<th>Mean Expenditure</th>
<th>Standard Deviation</th>
<th>Coefficient of Variations</th>
<th>Sum of All Expenditures</th>
<th>Relative Frequency of All Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Under 30</td>
<td>189</td>
<td>.145</td>
<td>.466</td>
<td>88</td>
<td>Under $250</td>
<td>.284, .227, .239, .119, .136</td>
<td>100</td>
<td>1068.7</td>
<td>1350.3</td>
<td>1.26</td>
<td>498.0, 94.04, 18.07</td>
</tr>
<tr>
<td>30-40</td>
<td>311</td>
<td>.238</td>
<td>.460</td>
<td>143</td>
<td>$250-$500</td>
<td>.343, .161, .252, .114, .126</td>
<td>100</td>
<td>1062.5</td>
<td>1474.5</td>
<td>1.39</td>
<td>488.7, 151.93, 29.20</td>
</tr>
<tr>
<td>40-50</td>
<td>297</td>
<td>.227</td>
<td>.424</td>
<td>126</td>
<td>$500-$1000</td>
<td>.310, .230, .222, .135, .103</td>
<td>100</td>
<td>919.2</td>
<td>1133.2</td>
<td>1.23</td>
<td>389.7, 115.82, 22.26</td>
</tr>
<tr>
<td>50 +</td>
<td>510</td>
<td>.390</td>
<td>.476</td>
<td>243</td>
<td>$1000-$2000</td>
<td>.350, .276, .259, .70, .45</td>
<td>100</td>
<td>652.6</td>
<td>896.9</td>
<td>1.37</td>
<td>310.6, 158.57, 30.47</td>
</tr>
<tr>
<td></td>
<td>1307</td>
<td>100.0</td>
<td>600</td>
<td></td>
<td></td>
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</tr>
</tbody>
</table>

standard deviation and coefficient of variation associated with levels of expenditure in each value category of the explanatory variable. These statistics have to be interpreted with caution. Quite apart from sampling considerations, the wide variance in levels of annual expenditures on maintenance and repairs greatly influences the mean. Hence, as the large coefficients of variation which typically appear in column 13 show, the mean cannot be treated as a particularly instructive measure.

Column 14 of the typical table is an attempt to integrate information on the incidence of expenditure with the actual amount spent. The expected value of expenditures with respect to any category \((i)\) of the explanatory variable is the product of the probability of a non-zero expenditure times the size of the non-zero expenditure. That is

\[
E(Y \mid X)_i = p(Y^* > 0)_i \cdot E(Y \mid Y^* > 0)_i,
\]

where \(Y^*\) is equal to 1 or 0 depending upon whether expenditures were made or not, and \(Y\) is the mean level of expenditure for the \(i^{th}\) category of the explanatory variable \(X\). Hence \((Y \mid X)_i\) is given in column 3 (times 100) and \(E(Y \mid Y^* > 0)_i\) in column 11 of the typical table. This measure, by virtue of its use of the mean also warrants special care in interpretation.

Column 15 presents the sum of all repair expenditures made by members of the relevant value category of the explanatory variable. As such this measure reflects both the number of cases and the sum of all their repair expenditures. Column 16 indicates the percentage distribution of this item over values of the explanatory variable. This last column conveys considerable information for it allows the distribution of maintenance and repairs to be compared directly to the distribution of households over the value categories of the explanatory variable (column 3).

Age of Owner and Expenditure on Repairs

In Table 2, the propensity to spend anything on repairs in a given year -
the incidence of expenditure - is not systematically related to the age of head of household (column 3). Any of the observed differences in the likelihood of non-zero expenditure could have occurred by chance, as indicated by the insignificant chi-square statistic computed from the 4 x 2 table formed from column 1 and 4.

When it comes to levels of expenditure within the subgroup of homeowners who made repairs, then it can be seen that it is the younger buyers who spend most on repairs and maintenance. This result is clearly reflected both in the mean expenditure in column 11 of Table 2 and in the fact that 25.0 percent of owners under 20 years spent over $1000 compared to under half that proportion for those over 50 years old (see columns 5 and 6). Moreover the amount spent appears to decline in a systematic manner with age of head. The chi-square test as reported for the 4 x 5 contingency table formed from columns 5 through 9 demonstrates a statistically significant departure from the independence model.

By way of further support for the negative association of repair expenditure with age of head, whereas older persons (those over 50 years) make up nearly 40 percent of the population (column 2), they only make 30 percent of all expenditures on repairs. Finally, the expected value, column 14, which combines in one measure both the incidence and the levels of expenditure, reveals nearly a $200 difference in expected repair expenditure per annum between the under 20 and over 50 age groups.

On the basis of the discussion above relating the amount spent on "repairs" \( \hat{R} \), to their value \( \hat{V} \), the variance in \( \hat{V} \) due to age would be expected to be under represented by these data. Younger buyers, in addition to actually spending more money on repairs, are likely to invest considerably more unpaid labour. By contrast, in the case of older residents, their estimate of \( \hat{R} \) would more closely approximate the value \( \hat{V} \) at least on the grounds of their greater reliance on contract or paid labour.
The distribution of 'repair' expenditure over the various categories of household income is shown in Table 3. These results show that the incidence of repair and maintenance expenditure does not vary greatly over income categories (column 3, Table 3); although if the highest and lowest income groups alone are considered then a statistically significant difference can be generated.

Turning to those respondents who reported 'repair' expenditure, the table shows that the level of expenditure is clearly much higher in the higher income groups. The chi-square statistic indicates that the differences apparent in the $3 \times 5$ table formed from column 5 through 9 are in fact significant at the 0.2 percent level. The distribution of discrepancies from the independence model (not shown) confirms the importance of high income groups as large investors in stock conservation and upgrading.\(^\text{14}\)

While the variance is especially high in some of these high income categories (column 13) the expected monetary value of "repairs" by those households with incomes over $22,500 per annum is nearly twice that of those with $7,500 or less.

Whereas the lowest income group performs over 14 percent of all repair expenditure they occupy over 20 percent of all households. The reverse is the case for the highest income group which make up 14 percent of all households but contribute over 20 percent of all "repair" expenditures.

Some of the variation in "repair" expenditure over income categories may be due to measurement errors. Firstly, a significant but unknown proportion of renovation as opposed to maintenance and repairs is likely present here, raising the relative importance of contributions from the high income groups.

The second reason may be the deviation of $\hat{R}$ from $\hat{V}$ over the income domain as shown in Figure 1 above. It is the middle income groups where "maintenance and repair" expenditures are most likely to underestimate the value of improvements. This alone would account for the fact that both the incidence
TABLE 3
EXPENDITURE ON MAINTENANCE AND REPAIR BY HOUSEHOLD INCOME CLASS
TORONTO, 1973

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>&lt; 75</td>
<td>263</td>
<td>20.1</td>
<td>42.6</td>
<td>112</td>
<td>33.3</td>
<td>28.9</td>
<td>25.0</td>
<td>7.3</td>
<td>5.3</td>
</tr>
<tr>
<td>75-99</td>
<td>189</td>
<td>14.5</td>
<td>48.7</td>
<td>92</td>
<td>32.3</td>
<td>23.5</td>
<td>26.5</td>
<td>9.8</td>
<td>7.8</td>
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<tr>
<td>100-124</td>
<td>172</td>
<td>13.2</td>
<td>42.4</td>
<td>73</td>
<td>32.3</td>
<td>23.5</td>
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<td>125-149</td>
<td>154</td>
<td>11.8</td>
<td>46.8</td>
<td>72</td>
<td>33.3</td>
<td>16.7</td>
<td>22.3</td>
<td>13.5</td>
<td>14.1</td>
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<tr>
<td>150-174</td>
<td>136</td>
<td>10.4</td>
<td>43.4</td>
<td>59</td>
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<tr>
<td>175-224</td>
<td>207</td>
<td>15.8</td>
<td>48.8</td>
<td>101</td>
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<tr>
<td>225+</td>
<td>186</td>
<td>14.2</td>
<td>48.9</td>
<td>91</td>
<td></td>
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<tr>
<td></td>
<td>1307</td>
<td>100</td>
<td></td>
<td>600</td>
<td>x^2 19.64 &gt; 18.17 ( \alpha = .02 ) &amp; df=8</td>
<td></td>
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</tr>
</tbody>
</table>

of repairs tends to be lowest in the middle income categories and why the rate of increase in average "repair" expenditure with income falls in these middle income categories.

The Timing of "Repair" Expenditures

In a housing market where many properties are substitutes for others in terms of the housing services they can supply, either directly or after renovation, the decision to make repairs to an older, lower quality property may be set against the alternative of buying a superior property to begin with. These kinds of alternatives are weighted by many households who consider purchase and the decisions they make affect the level of repairs made.

It follows from such a perspective that, in many cases, the decision to purchase a given property and the decision to make repairs to it will not be independent decisions. Rather properties are evaluated at the time they are marketed, not just in terms of their present level of quality but for their potential quality level, the difference being generated through the kinds of "repair" expenditure discussed here.

The amount spent on repairs may be viewed as the difference between the initial quantity of housing services a dwelling provides q, and the buyer's desired amount, q*. Thus the amount of "repairs" made is both a measure of and a reflection of the difference q*-q.

In most cases there is a simultaneous determination of q and q*-q which makes it quite artificial to assume q to be fixed or for it to be treated as a sunk cost for the purposes of say modelling the optimal level of q*(for example see Dildine and Massey, 1974). Most households do not suddenly begin to think about the kinds of 'repairs' they will make after they purchase and occupy a property. Rather future 'repairs' are an integral part of the calculation a household makes of his future housing needs before purchase.

This view of the way decisions on repairs are made has important
implications for the way this whole question of repair and maintenance is analysed. A variable which is central to such a view, both conceptually and empirically, is length of owner occupancy and this will be used to elaborate the above argument.

The Length of Occupancy Variable

One way to examine the relationship between the choice of a certain level of housing q and the subsequent level of "repair" expenditure q*-q is through the length of occupancy variable. If a property is bought for its potential, that is to provide through subsequent expenditure the kind of housing likely to be required up to some future period, then the household who wishes to optimize its utility over its period of occupancy will be expected to carry out such improvements fairly soon after purchase.

In most cases budget constraints (and perhaps time and information constraints as well) will lead to modifications in the rate at which repairs can be carried out. The result of a desire to make "repairs" as soon as possible after purchase which is subject to budget constraints may be expressed as a sequence of "repairs" declining in magnitude from the date of purchase. Each single curve in Figure 3a shows the value of "repairs" cumulated after each time period (say each year) after purchase t_p, from zero at q (the level of housing services available from the purchased structure) to q* the desired level of housing so many years after purchase.

The convex curve implies decreasing marginal rates of repair expenditure after purchase. These declining marginal values of repair as portrayed (on a larger scale) in Figure 3b reflect the assumption that an owner occupier will attempt to raise the quantity of housing services at least to some satisfactory or livable level as soon after purchase as possible. From then on each additional (say annual) expenditure on repair will yield slightly less of an addition to his living comfort (or amelioration of his living discomfort).
VALUE OF REPAIRS BY TIME SINCE PURCHASE.
CUMULATIVE AND MARGINAL EXPENDITURES

3a.

Cumulative Value of Repair Expenditures

3b.

Value of Repair Expenditures
Furthermore, after initial outlays, housing repairs will compete with diminishing weight against alternative expenditures open to the owner.

Three classes of new purchaser are represented in Figure 3:a,b and c. They are differentiated by their budget constraints so that even though each envisages carrying out the same value of repairs these will be spread out over different periods. Correspondingly, certain level of housing services are reached by the different owners at different times from the date of purchase.

This perspective on the value of repairs has a number of implications. The substantive ones include the relationship between the costs of purchase of the structure itself, in particular the loan to value ratios and mortgage costs.

The market circumstances surrounding purchase of a property may have important effects at least on the timing of repair expenditures and perhaps the level of them as well. While of interest, these facets of the problem lie outside the scope of this paper though some have been explored elsewhere in connection with residential property conversion (see Morrison, 1978, Chapter 6). What is of more immediate concern in this paper is how the methological constraints which cross sectional surveys impose bear on our analysis of repair expenditure when the timing of repairs is a systematic component of the process itself. To this question of timing we may now add the relationship between measurement errors in the dependent variable and the nature of the budget constraint.

Inputs to the Provision of Housing, Estimates of "Repair" and the Sequence of Repair Expenditure

Two features considered in Figure 3 may be related to characteristics of buyers themselves. The first concerns the amount of repairs q*-q and the second relates the relationship between the shape of the curves to the composition of inputs used in "repairs". Both may be systematically related to the monetary resources available to the purchaser immediately after occupancy.
Any given purchaser has the option of using different combinations of capital (especially savings and liquid assets), current revenue or income and available labour in obtaining his desired level of housing $q^*$. At the time of purchase, the buyer chooses that combination of inputs, $K$, $L_p$, and $L_u$ which will allow him to obtain his highest indifference curve for housing $q^*$. High ratios of $L_u$ to $K$ and $L_p$ usually reflect the purchase of older, lower quality housing. In otherwords the buyer will make good the difference $q^*-q$ primarily with unpaid labour. The result is a tendency for a systematic positive relationship between the use of unpaid labour and the amount of repairs to be carried out.

If the systematic influence of period after purchase is related to the nature of the dependent variable in this analysis some further features of the repair process can be suggested. The purchase of a dwelling where the level of housing services $q$ is below the desired level $q^*$ may reflect the choice of the household to draw on non-monetary resources in order to obtain $q^*$, namely the use of own labour and that contributed by family and friends ($L_u$).\textsuperscript{15} Expenditure with low monetary components may be carried out first, shortly after purchase. Only once capital used up in the purchase of the property is again accumulated will the ratio $L_u : L_p + K$ become smaller.\textsuperscript{16}

This characteristic of the timing of expenditure also has implications for the way we interpret the evidence to follow. Since buyers with greater spreads between $q$ and $q^*$ are likely to have higher levels of unpaid labour to contract labour the value of repairs $V$ attributed to this kind of owner if measured by $R$ will be under estimates. The degree of underestimation will increase the shorter his length of occupancy.

These arguments may be restated using Figure 4. Two sets of owners $a$ and $b$ have the same desired level of housing $q^*$ but purchase dwelling structures yielding housing services $q_a$ and $q_b$. At $t_s$, the date of the repair survey as measured from the time of purchase, one set of owner occupiers would be observed to have spent dollars equivalent to $q_{a1} - q_a$ whereas another set of
FIGURE 4

COMPOSITION OF INPUTS TO HOUSING, THE DIFFERENCE BETWEEN HOUSING SERVICES FROM THE PURCHASED STRUCTURE \((q)\) AND THE DESIRED LEVEL OF HOUSING SERVICES \((q^*)\), AND THE LENGTH OF OWNER OCCUPANCY
owner occupiers b, will have spent only $q_b$ - $q_b$. Since only monetary expenditures are recorded, the buyer with the lower monetary resource level be will be accredited with spending very little, whereas with the value of repairs generated through unpaid labour $L_u$ included both sets of owners will be recorded as having contributed equally in terms of the value of repairs, 

$$(q_a - q_a) = (q_b - q_b).$$

Moreover it is possible, as Figure 4 seeks to illustrate that over the long term the owner b will in fact have contributed considerably more in terms of value V than owner a: 

$$(q^* - q^*) < (q^*_b - q^*_b).$$

Repairs Many Years After Purchase

So far only the years following purchase have been considered. While the relationship between repairs and housing potential as evaluated by the purchaser can be expected to hold in these years, other factors not foreseen at the time of purchase may arise later in the occupancy period.

At least two decisions by long term residents may be identified – the decision to upgrade housing and the decision to address physical deterioration in the dwelling. Both may lead to a rise in the amount of repair expenditure later in the occupancy period. The result would be distribution of repair expenditures by length of ownership as depicted in Figure 5.

The average length of owner occupancy in Toronto has been estimated at between 8 and 10 years (Brown, 1977). Thus the typical owner may be viewed as deciding whether to upgrade his housing through moving or through adding additional services to his dwelling unit. In the longer length of ownership we only observe those who stay and a rise in repairs is anticipated for those groups about this time.

There is a second factor which means that repairs may in fact be greater than that necessary to account for any upgrading in housing. The physical structure will deteriorate over the time following purchase $t_p$ and
FIGURE 5

THE VALUE OF REPAIRS OVER THE FULL OWNER OCCUPANCY PERIOD
maintenance expenditure are required to ensure $q^*$ remains constant. Thus repairs among long term residents will reflect both a revised desired level of housing $q^{**}$ and the need for a greater level of repair expenditure to counter physical deterioration. This may be expressed as:

$$V_{t_{x}} = f((q^{**}-q^*) + \theta q^*)_{t_{x}}, \text{ approx. } 8 \text{ years} < t_{x} < 15 \text{ years},$$

where $q^{**}$ is the new level of housing demand which in many cases will be greater than $q^*$. It is assumed that $q^*$ will have been reached by $t_{x}$ and that the amount which has to be spent on maintenance is a function of the annual decay parameter $\theta$. ($0 > \theta < 1.0$).

It is appropriate at this stage to turn to some empirical evidence. However a problem arises because the cross sectional empirical data are not ordered on a length of occupancy scale. What is available is a sample of owners at different stages in their occupancy history but whose supplementary information, such as income, age, purchase related data and so on, pertain only to the current year which may in fact be any year from the time of purchase. Nevertheless even with these limitation some support for the above arguments can be suggested.

In the discussion to follow the uncontrolled association between length of occupancy and repair expenditure is analysed and then some preliminary controls are introduced and their effect assessed. It is worth emphasising that length of occupancy is calculated in the number of years prior to January 1973, the year for which the "repairs" were reported.

Length of Occupancy and Expenditure on Repairs

The statistical relationship between repairs made in 1973 and the year of purchase is presented in Table 4. Despite the non-uniform percentages regarding the incidence of non-zero expenditure (column 3), there is no statistically significant relationship between the incidence of repairs and length of owner occupancy.

When it comes to the amount of expenditure however, the length of
| Length of Occupancy (in years prior to Oct. 1973) | Year of Purchase | Frequency in Each Category | Relative Frequency | Proportion Making Expenditure | Number Making Expenditure | Mean Expenditure | Standard Deviation | Coefficient of Variation | Expected Value | Sum of All Expenditure | $100 | Relative Frequency of All Expenditure |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| > 32 | Pre 1940 | 51 | 4.36 | 49.0 | 25 | 36.8 | 27.1 | 27.0 | 3.9 | 5.2 | 100 | 500.9 | 538.7 | 1.11 | 207.5 | 29.05 | 5.77 |
| 22-32 | 1941-50 | 89 | 7.61 | 37.1 | 33 | 36.8 | 27.1 | 27.0 | 3.9 | 5.2 | 100 | 536.5 | 809.8 | 1.51 | 255.4 | 26.82 | 5.33 |
| 18-22 | 1951-55 | 105 | 8.98 | 47.6 | 50 | 36.8 | 27.1 | 27.0 | 3.9 | 5.2 | 100 | 729.8 | 735.3 | 1.01 | 361.2 | 34.30 | 6.81 |
| 14-18 | 1956-59 | 95 | 8.13 | 49.5 | 47 | 36.8 | 27.1 | 27.0 | 3.9 | 5.2 | 100 | 848.2 | 1053.3 | 1.24 | 438.1 | 39.86 | 7.92 |
| 12-14 | 1960-61 | 48 | 4.11 | 50.0 | 24 | 36.8 | 27.1 | 27.0 | 3.9 | 5.2 | 100 | 1009.1 | 1310.6 | 1.30 | 522.7 | 59.53 | 11.82 |
| 10-12 | 1962-63 | 43 | 3.68 | 53.5 | 23 | 36.8 | 27.1 | 27.0 | 3.9 | 5.2 | 100 | 1209.3 | 1638.6 | 1.24 | 566.4 | 91.75 | 18.22 |
| 8-10 | 1964-65 | 84 | 7.18 | 54.8 | 46 | 36.8 | 27.1 | 27.0 | 3.9 | 5.2 | 100 | 1536.5 | 1945.8 | 1.24 | 735.3 | 73.53 | 14.82 |
| 6-8 | 1966-67 | 114 | 9.75 | 51.8 | 59 | 36.8 | 27.1 | 27.0 | 3.9 | 5.2 | 100 | 1735.8 | 2145.1 | 1.24 | 900.1 | 90.02 | 17.82 |
| 4-6 | 1968-69 | 126 | 9.49 | 52.3 | 58 | 36.8 | 27.1 | 27.0 | 3.9 | 5.2 | 100 | 1935.1 | 2345.4 | 1.24 | 1064.4 | 106.43 | 19.82 |
| 2-4 | 1970-71 | 162 | 13.85 | 56.8 | 92 | 36.8 | 27.1 | 27.0 | 3.9 | 5.2 | 100 | 2135.4 | 2545.7 | 1.24 | 1224.7 | 122.48 | 22.82 |
| < 2* | 1972-73 | 267 | 22.84 | 47.20 | 126 | 36.8 | 27.1 | 27.0 | 3.9 | 5.2 | 100 | 2335.7 | 2746.0 | 1.24 | 1384.0 | 138.41 | 25.82 |
| 1169 | 100.0 | 583 | 1169 | 100.0 | 583 | 1169 | 100.0 | 583 | 1169 | 100.0 | 583 | 1169 | 100.0 | 583 | 1169 | 100.0 | 583 | 1169 | 100.0 | 583 | 1169 | 100.0 | 583 | 1169 | 100.0 | 583 |

\[ x^2 = 16.61, \alpha = .05, \text{df}=8 \]

*This represents the minimum and maximum length of occupancy for owners resident in 1974 who bought their dwelling.

occupancy shows a distinct negative relationship to the amount spent on repairs. The discrepancies between observed frequencies in the 3 x 5 cross tabulation (columns 5 through 9 in Table 4) and those expected under the independence hypothesis are sufficient to generate a chi-squared value of $X^2 = 16.61$ which is significant at the five percent level. Inspection of the discrepancies from the independence model show that larger expenditures are made by new owners (those resident for less than 4 years, 1970-1973 inclusive). Whereas new occupants make up just over one third of all occupiers (36.7 percent, column 2), they are responsible for nearly half (48.5 percent) of all repair expenditures.

These conclusions are supported by other statistics in Table 4. The mean level of expenditure shows an increase with more recent purchasers, albeit in an irregular manner. The expected value is also consistent with the hypothesis that recent buyers spend proportionally more on "repair". However the higher degree of variance in these cases (column 13), does suggest that large average expenditures are being unduly inflated by the presence of one or two very large expenditures by a small number of households.

While the average levels of 'repair' expenditure is being inflated by outlying large expenditure these may well simply reflect large investments such as furnace replacement or replumbing tasks. Without clearer evidence on renovation it would be premature to reevaluate the table excluding the outlying observations. For one thing those one or two very large expenditures occur in all length of occupancy categories.

These results are consistent with the argument advanced above in Figure 4, which suggested that the effect of recent purchase on $\hat{Y}$ is underestimated by $\hat{R}$ because of the positive relationship between the ratio of unpaid labour to other inputs and length of ownership. To this must also be added composition effects; new buyers tend to be younger and their use of unpaid labour is also higher.

The results also offer some confirmation for the secondary set of repairs,
those occurring in order to upgrade the unit and those made in response to
physical decay. The expected value of expenditures show a rise in the period
10-19 years after purchase and a fall to a much reduced level after 18 years.

These results are tentative. So far there has been no attempt to
control for composition of the sample in order to assess the independent effect
of length of ownership. For this reason, the effect of average expenditure by
length of occupancy controlling for age of head of household will now be
evaluated.

Controls: Age of Head

Since younger households are more likely to be among recent purchasers
and younger owner occupiers spend more on repairs, to what extent do higher
average annual levels of expenditure observed in more recently purchased residential
property reflect the fact that such purchases are likely to be in the younger age
groups?

It is appropriate to ask what marginal effect knowing the age of owner
has on the probability of a given level of expenditure by a buyer with a given
ownership period. One test will suffice, namely the hypothesis that even
within particular age groups, maintenance and repair expenditure will be negatively
associated with length of owner occupancy.

Since both age and length of occupancy are highly correlated, it is
only with the more recent entrants that sufficient variation exists in the age
variable to construct a meaningful test. For this reason, Table 5 is confined to
two age of head groups and three recent occupancy duration periods.

The results are presented in terms of mean expenditure. A comparison
of these means in Table 5 shows that expenditure does increase with decreases
in length of occupancy within the two age groups identified. With respect to
those buying 2-4 years prior to making repair expenditures, it is the older
purchasers who are apparently spending more on "repairs".
TABLE 5

MAINTENANCE AND REPAIR EXPENDITURE BY LENGTH OF OWNER OCCUPANCY
CONTROLLING FOR AGE OF OWNER

<table>
<thead>
<tr>
<th>Length of Occupancy</th>
<th>Age of Head of Household (in 1974)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Under 35 years</td>
</tr>
<tr>
<td>Years</td>
<td>Date</td>
</tr>
<tr>
<td>4-6</td>
<td>1968-69</td>
</tr>
<tr>
<td></td>
<td>n=21</td>
</tr>
<tr>
<td>2-4</td>
<td>1970-71</td>
</tr>
<tr>
<td></td>
<td>n=44</td>
</tr>
<tr>
<td>4.2</td>
<td>1972-73</td>
</tr>
<tr>
<td></td>
<td>n=74</td>
</tr>
</tbody>
</table>


The result in Table 5 is also consistent with the argument given in Figure 3 with respect to the differences in buyers a, b and c. Buyers whose capital and monetary resources are less depleted after purchase, particularly those with higher levels of wealth, will be able to reach their desired level of housing services \( q^* \) at a faster rate than those whose capital and monetary resources have to be gradually accumulated after purchase. (A point to note about Figure 3 and Table 5 is that these repairs simply reflect repair decisions taken in one year and they say nothing necessarily about the investment potential of certain kinds of buyers, over their occupancy period as a whole.)

Figure 4 is also relevant in interpreting Table 5. Younger buyers are likely to have the value of their repair investment biased downward relative to older buyers due not only to the greater propensity to use unpaid labour but also because the ratio of \( L_u \) to \( K + L_p \) is likely to be highest in the years immediately following purchase.
Controls: Age of Stock

The analysis of the stock as a whole may lead to a downward estimate of the effect of recency of purchase on the degree of maintenance and repair expenditure. This is because newer properties are associated with more recent occupancy and yet these are less likely to require repair expenditure. In order to present a more controlled picture of the particular role of length of owner occupancy the same analysis was performed for owners who purchased dwelling units in properties built before 1950.

The results obtained from this sample (n=601) given in Table 5 offer strong support for the importance of length of occupancy. The collapsed cross-tabulation in Table 5 (columns 5 through 9) shows that recent buyers of old properties are far more likely to spend large amounts of money (over $1000) on repair (and no doubt rehabilitation), than are longer term residents. This difference is clearly reflected in the chi-square statistic; $\chi^2 = 26.12 < 32.17, \alpha = .001$. The mean expenditure (column 11) confirms this result. From a comparison of column 2 and 16 in Table 5, new occupants, (those entering up to 5 years prior to 1973) spent almost half (49.2 percent) of all repair expenditure on older housing despite the fact that these households made up just over one quarter (26.9 percent) of all owner occupying households. This is a greater discrepancy than was noted in Table 4 for the stock as a whole.

There is a complex relationship involving age of owner, the potential for repair in the older stock and the propensity to use unpaid labour which inhibit any categorical statement of this result. It would appear however that whatever the countervailing factors such as higher use of family labour by ethnic groups owning older properties (see Krohn, 1977), that the combinations of young entrants to the older Toronto housing stock during the early 1970s may have inflated the apparent importance of recent length of occupancy per se. Clearly a very carefully specified multivariate model is required to separate out even these few factors and any conclusions should be tested against patterns
TABLE 5

EXPENDITURE ON MAINTENANCE AND REPAIRS BY LENGTH OF OWNER OCCUPANCY. PRE 1950 HOUSING STOCK

<table>
<thead>
<tr>
<th>Length of Occupancy (in years prior to Dec. 31, 1973)</th>
<th>Year of Purchase</th>
<th>Frequency</th>
<th>Relative Frequency</th>
<th>Proportion Making Expenditure</th>
<th>Number Marking Expenditure</th>
<th>Under $250</th>
<th>$250-$500</th>
<th>$500-$1000</th>
<th>$1000-$2000</th>
<th>$2000 and over</th>
<th>Mean Expenditure</th>
<th>Standard Deviation</th>
<th>Coefficient of Variation</th>
<th>Expected Value</th>
<th>Sum of All Expenditure $'00</th>
<th>Relative Frequency of All Expenditure</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 32 Pre 1940</td>
<td></td>
<td>140</td>
<td>23.2</td>
<td>17.1</td>
<td>58</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>500.9</td>
<td>558.7</td>
<td>1.11</td>
<td>85.6</td>
<td>29.1</td>
<td>8.99</td>
</tr>
<tr>
<td>22-32 1941-50</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>534.4</td>
<td>906.9</td>
<td>1.70</td>
<td>45.4</td>
<td>15.5</td>
<td>4.79</td>
</tr>
<tr>
<td>18-22 1951-55</td>
<td></td>
<td>58</td>
<td>9.6</td>
<td>8.5</td>
<td>29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>792.3</td>
<td>793.4</td>
<td>1.00</td>
<td>56.2</td>
<td>19.0</td>
<td>5.87</td>
</tr>
<tr>
<td>14-18 1956-59</td>
<td></td>
<td>45</td>
<td>7.4</td>
<td>7.1</td>
<td>24</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1025.0</td>
<td>1233.2</td>
<td>1.20</td>
<td>69.7</td>
<td>23.6</td>
<td>7.29</td>
</tr>
<tr>
<td>12-14 1960-61</td>
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<td>40</td>
<td>6.6</td>
<td>6.8</td>
<td>23</td>
<td></td>
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<tr>
<td>10-12 1962-63</td>
<td></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>537.4</td>
<td>546.4</td>
<td>1.02</td>
<td>36.5</td>
<td>12.3</td>
<td>3.80</td>
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<td>8-10 1964-65</td>
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<td>6.0</td>
<td>6.8</td>
<td>23</td>
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<td>971.1</td>
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<td>114.6</td>
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<td>4-6 1968-69</td>
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<td>10.6</td>
<td>36</td>
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<td>1373.6</td>
<td>1478.7</td>
<td>1.07</td>
<td>193.7</td>
<td>65.9</td>
<td>20.4</td>
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<td>2-4 1970-71</td>
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<td>76</td>
<td>12.6</td>
<td>14.1</td>
<td>48</td>
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<tr>
<td>601 100</td>
<td></td>
<td>339</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>


$X^2 = 32.17, \alpha = .001, df=8$
in other Canadian cities.

Property Characteristics and Expenditures on Repairs

Three central characteristics of the dwelling unit itself are examined in this section - the period of original construction or vintage of the property, the market value of the property and finally property type. Unfortunately the SHU data do not allow location within the survey area to be explicitly defined and therefore some of the assumptions present in Canadian housing rehabilitation policy such as the concept of improvement areas and the implicit assumption of contagion cannot be explicitly tested. Nevertheless, property vintage does allow some broad area divisions to be inferred.

Period of Construction

The results relating annual repair expenditure to property vintage are given in Table 6. Older properties were more likely to receive at least some repair expenditure than newer properties, in fact column 3 of Table 6 shows a regular decrease in the probability of non-zero expenditure by property vintage. The incidence of reported expenditure on properties built before 1941 is nearly twice as high as that reported for properties built in the 15 years prior to the survey.

The relationship between repair expenditure and property characteristics is not quite as systematic once levels of expenditure are addressed. Unlike the distribution of incidence of expenditure (column 3) the average amount spent is not monotonically associated with the period of construction. As column 10 of Table 7 shows, the average expenditure on dwellings built before the 1950s is nearly a thousand dollars ($956; n=351), compared to over two thirds that amount for properties built between 1951 and 1960 ($685; n=132), and more than two thirds for properties built after 1960 ($775; n=132).
### TABLE 6

EXPENDITURE ON MAINTENANCE AND REPAIRS BY PROPERTY VINTAGE

<table>
<thead>
<tr>
<th>Vintage</th>
<th>Frequency in Each Category</th>
<th>Relative Frequency</th>
<th>Proportion Making Expenditures</th>
<th>Number Making Expenditures</th>
<th>Proportion Making Specific levels of Expenditure</th>
<th>Mean Expenditure $</th>
<th>Standard Deviation $</th>
<th>Coefficient of Variation</th>
<th>Expected Value</th>
<th>Sum of All Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre 1941</td>
<td>503</td>
<td>28.5</td>
<td>54.1</td>
<td>272</td>
<td>29.0 - 23.9 - 27.9 - 8.1 - 11.0</td>
<td>100</td>
<td>950</td>
<td>1291.1.36 - 355.75</td>
<td>258.42</td>
<td>49.7</td>
</tr>
<tr>
<td>1941-1950</td>
<td>148</td>
<td>11.3</td>
<td>51.4</td>
<td>76</td>
<td>27.6 - 27.6 - 22.4 - 11.8 - 10.5</td>
<td>100</td>
<td>1005</td>
<td>1398.1.39 - 113.56</td>
<td>76.35</td>
<td>14.7</td>
</tr>
<tr>
<td>1951-1960</td>
<td>294</td>
<td>22.5</td>
<td>44.9</td>
<td>132</td>
<td>34.1 - 22.0 - 25.0 - 14.4 - 4.5</td>
<td>100</td>
<td>685</td>
<td>749.1.09 - 154.12</td>
<td>90.47</td>
<td>17.4</td>
</tr>
<tr>
<td>1961 +</td>
<td>362</td>
<td>27.7</td>
<td>33.1</td>
<td>120</td>
<td>44.2 - 20.0 - 18.3 - 9.2 - 8.3</td>
<td>100</td>
<td>793</td>
<td>1171.1.48 - 219.66</td>
<td>95.13</td>
<td>18.3</td>
</tr>
<tr>
<td></td>
<td>1307</td>
<td>100.00</td>
<td>600</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>520.37</td>
</tr>
</tbody>
</table>

\[ \chi^2 = 19.37, \sigma = .08, df=12 \]

The (row) proportions given in columns 5 through 9 of Table 6 show that residential properties built before 1950 receive a higher proportion of larger expenditures (over $1000). Home owners in newer housing stock, as well as being less likely to make expenditures also make smaller investments; over 60 percent of owners of housing built after 1961 spent less than $500. Column 15 of Table 6 shows that over half of the private funds allocated for repair expenditure were directed to residential properties over 30 years of age. This may not be surprising but what is worth noting is that 18 percent was spent on properties less than 15 years old. Finally on the basis of column 14 of Table 6, the highest expected values of expenditure are to be found in the oldest and youngest properties. These patterns may be related to the fact that properties built during the 1940s and 1950s typically house owners with longer than average periods of occupancy. In other words short lengths of occupancy and by association young age of heads and higher annual repair expenditures are most likely to be found in the relatively old and the relatively new sections of the housing stock.

Market Value of the Property

Owners' estimates of property value allow the expenditure on maintenance and repair to be related to a general index of property condition and relative position in the market. For this analysis, the stock has been divided into five value categories. The results are presented in Table 7.

The incidence of expenditure by value class (column 3 of Table 7) shows that a larger proportion of owners in lower valued properties make expenditures than those in higher valued properties. However the test of a systematic direction to this incidence of expenditure made on the 5 x 2 table (column 1 and 4) does not give a statistically significant result. If the table is partitioned into a 2 x 2 array with the lowest value as one category and 'the rest' as the other, then a significant chi-square value (2.06) does result, namely that the largest expenditures were made in the highest valued dwelling units. Thirty
TABLE 7

EXPENDITURE ON MAINTENANCE AND REPAIRS BY PROPERTY VALUE

<table>
<thead>
<tr>
<th>Sale Price* ($'000 1973)</th>
<th>Frequency in Each Category</th>
<th>Relative Frequency</th>
<th>Proportion Making Expenditures</th>
<th>Proportion Making Number Making Expenditures</th>
<th>Under $250</th>
<th>$250-$500</th>
<th>$500-$1000</th>
<th>$1000-$1000</th>
<th>$2000 and over</th>
<th>Total</th>
<th>Mean Expenditure</th>
<th>Standard Deviation</th>
<th>Coefficient of Variation</th>
<th>Expected Value</th>
<th>Sum of All Expenditures</th>
<th>Relative Frequency of All Expenditures</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-39.9</td>
<td>148</td>
<td>12.26</td>
<td>51.33</td>
<td>77</td>
<td>29.9</td>
<td>31.2</td>
<td>20.8</td>
<td>11.7</td>
<td>6.5</td>
<td>100</td>
<td>774.7</td>
<td>1043.5</td>
<td>1.35</td>
<td>397.6</td>
<td>59.65</td>
<td>12.1</td>
</tr>
<tr>
<td>40-49.9</td>
<td>225</td>
<td>18.64</td>
<td>46.52</td>
<td>107</td>
<td>33.6</td>
<td>26.2</td>
<td>26.2</td>
<td>4.7</td>
<td>9.3</td>
<td>100</td>
<td>864.0</td>
<td>1368.5</td>
<td>1.58</td>
<td>401.9</td>
<td>92.45</td>
<td>18.7</td>
</tr>
<tr>
<td>50-59.9</td>
<td>285</td>
<td>23.61</td>
<td>46.21</td>
<td>134</td>
<td>35.1</td>
<td>20.9</td>
<td>25.4</td>
<td>8.2</td>
<td>10.4</td>
<td>100</td>
<td>879.2</td>
<td>1155.3</td>
<td>1.31</td>
<td>406.3</td>
<td>117.82</td>
<td>23.9</td>
</tr>
<tr>
<td>60-69.9</td>
<td>235</td>
<td>19.47</td>
<td>47.92</td>
<td>115</td>
<td>33.9</td>
<td>24.3</td>
<td>27.0</td>
<td>10.4</td>
<td>4.3</td>
<td>100</td>
<td>758.2</td>
<td>1083.9</td>
<td>1.43</td>
<td>363.3</td>
<td>87.20</td>
<td>17.7</td>
</tr>
<tr>
<td>70+</td>
<td>314</td>
<td>26.01</td>
<td>39.82</td>
<td>127</td>
<td>33.1</td>
<td>14.2</td>
<td>22.8</td>
<td>15.0</td>
<td>15.0</td>
<td>100</td>
<td>1074.9</td>
<td>1330.0</td>
<td>1.24</td>
<td>428.0</td>
<td>136.51</td>
<td>27.6</td>
</tr>
<tr>
<td>1207** 100.00</td>
<td>560</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTES:

*This indicates owners estimate of the selling price of the dwelling.

**Not all respondents stated a selling price, therefore this is a 1207/1307 = 92.3 percent sample of all sampled owner occupied units, and is a 560/600 = 93.5 percent sample of properties receiving expenditures.

percent of all annual expenditures by owners of properties with property values estimated to be $70,000 or more (26 percent of the sample in 1973) were in amounts of $1000 or more. At the same time however the chi-square statistic shows the differences observed are statistically significant only at the 10 percent level. Rerunning the test with the three middle value categories grouped raises the chi-square value of this 3 x 5 table to 18.168 generating a result which is significant at the 2 percent level, df=8.

A comparison of columns 2 and 16 in Table 7 reveals that the proportion of all repair expenditure going to each value category is very closely related to the number of such properties in the stock as a whole. However given the potentially greater need for repair and maintenance expenditure in lower valued sectors of the stock this also may be a forewarning of under-maintenance.

The fact that the incidence of expenditure and the level of expenditure are negatively and positively related to property value respectively means that the difference in the expected values of expenditure are reduced. The fact that the expected value is related in an irregular fashion to value reflects in part the lower level of both incidence and actual levels of expenditure in the category $60-70,000.

Type of Dwelling

Although confined to owner occupiers, a wide range of housing types is included in the subsample analysed thus far. Single detached properties make up nearly 67 percent. The others make up under 10 percent. In light of this composition it is instructive to ask whether the expenditures were more likely to be made in one type of housing as opposed to another.

Table 6 shows the incidence of expenditure and the discrepancies from the model of independent effects ($X^2=15.91, \alpha=.007$, df=5). A model based on the assumption that the proportion receiving non-zero expenditures was independent of the type of property specified and the discrepancies from such a model are
presented as column 4 in Table 8. They indicate that apart from the few cases of residential properties attached to non-residential, single detached properties were more likely to receive non-zero expenditure than their number in the sample would suggest. In contrast, duplex and row housing were much less likely to receive repair expenditures by their owners. To what extent this may represent special arrangements under condominium tenure or alternatively the relative newness of such structures is unclear (though both could be tested with the data at hand). If neither of these conditions apply, however, then possible undermaintenance of row structures would bear further inquiry.

**TABLE 8.**

**THE INCIDENCE OF NON-ZERO EXPENDITURE ON REPAIRS AND MAINTENANCE BY PROPERTY TYPE**

<table>
<thead>
<tr>
<th>Property Type</th>
<th>All Cases</th>
<th>Cases with Non-Zero Expenditures</th>
<th>Proportion Making Non-Zero Expenditure</th>
<th>Discrepancies from model of independent events</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single Detached</td>
<td>874</td>
<td>406</td>
<td>46.5</td>
<td>4.7</td>
</tr>
<tr>
<td>Semi Detached</td>
<td>319</td>
<td>129</td>
<td>40.4</td>
<td>1.3</td>
</tr>
<tr>
<td>Row</td>
<td>27</td>
<td>11</td>
<td>40.7</td>
<td>-17.4</td>
</tr>
<tr>
<td>Duplex</td>
<td>28</td>
<td>14</td>
<td>50.0</td>
<td>-1.4</td>
</tr>
<tr>
<td>Apartment, Flat</td>
<td>51</td>
<td>35</td>
<td>68.6</td>
<td>1.1</td>
</tr>
<tr>
<td>Attached to Non-Residential</td>
<td>8</td>
<td>5</td>
<td>62.5</td>
<td>11.6</td>
</tr>
<tr>
<td></td>
<td>1307</td>
<td>600</td>
<td></td>
<td>1.3</td>
</tr>
</tbody>
</table>

Interaction: Vintage, Value and Type of Property

Characteristics of the property are unlikely to have an independent influence on the incidence and level of expenditure and in order to discern the conditional relationship between levels of expenditure, Table 9 was constructed. This table shows two important relationships. Firstly, average expenditure rises with property value within each age of property category. Secondly, the variation of expenditure levels in a given housing age group is more marked over the value categories than between the age categories within each value category. Clearly, value and age of property are both important,
TABLE 9

EXPENDITURES ON MAINTENANCE AND REPAIRS BY VALUE CATEGORY AND TYPE OF DWELLING

<table>
<thead>
<tr>
<th>Vintage</th>
<th>Sale Price $'000</th>
<th>Single-Detached</th>
<th>Semi-Detached</th>
<th>Row, Duplex, Apartment</th>
</tr>
</thead>
<tbody>
<tr>
<td>$837</td>
<td>$980</td>
<td>$613</td>
<td>$835</td>
<td></td>
</tr>
<tr>
<td>n=186</td>
<td>n=93</td>
<td>n=59</td>
<td>n=34</td>
<td></td>
</tr>
<tr>
<td>$1044</td>
<td>$1157</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=120</td>
<td>n=90</td>
<td>n=16</td>
<td>n=14</td>
<td></td>
</tr>
<tr>
<td>$1213</td>
<td>$1264</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=45</td>
<td>n=34</td>
<td>n=1</td>
<td>n=10</td>
<td></td>
</tr>
<tr>
<td>$654</td>
<td>$576</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=33</td>
<td>n=23</td>
<td>n=7</td>
<td>n=3</td>
<td></td>
</tr>
<tr>
<td>$655</td>
<td>$655</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=74</td>
<td>n=58</td>
<td>n=4</td>
<td>n=1</td>
<td></td>
</tr>
<tr>
<td>$818</td>
<td>$844</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=25</td>
<td>n=2</td>
<td>n=1</td>
<td>n=0</td>
<td></td>
</tr>
<tr>
<td>$367</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=16</td>
<td>n=3</td>
<td>n=3</td>
<td>n=10</td>
<td></td>
</tr>
<tr>
<td>$553</td>
<td>$519</td>
<td>$602</td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=58</td>
<td>n=22</td>
<td>n=33</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$1111</td>
<td>$1093</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=58</td>
<td>n=49</td>
<td>n=8</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* $xxx = average expenditure
n = number of cases

each exerts an independent influence as well as interrelating with respect to their effect on levels of repair expenditure.

Only in the pre 1950 housing stock are there sufficient numbers to make comparisons of dwelling type groups within sale price categories. In this property age group, the tendency is for single detached properties to receive more expenditure than either semi-detached or the combined category of row, duplex and apartments - a result consistent with the results given in Table 9.

Conclusions and Data Requirements for Future Research

Canada has not seen the kind of analysis of maintenance and repair investment which one might have expected of a nation with a large and increasing stock of old housing. The existing stock of residential buildings is a substantial proportion of a nation's real wealth and that source of wealth can only be sustained through allocation of a suitable volume of maintenance and repair expenditure. Since this is primarily a function of the private sector and any responsibility for its failure to maintain the stock falls on the shoulders of the State in the form of demands for rehabilitation, public monitoring of private activity can be expected.

This study is a first attempt to address the volume and distribution of expenditures made by Canadian home owners. Although confined to one urban area, Toronto, the conclusions at least in their broad terms may also be valid for other larger Canadian cities. Among the lessons learnt from the study was that repair expenditure in any one year were made by only a small proportion of home owners. Furthermore certain types of owners and certain types of properties receive more investment than others.
The specific conclusions are given in the summary at the beginning of the paper and need not be repeated here. What will be raised in this conclusion however are the important qualifications which have to be made with respect to any questions about repairs: who makes them, where and in what types of property. Such qualifications are important primarily for what they say about the current state of data for such research in Canada.

The Question of Data

Even though governments at the national, provincial and municipal levels are now paying additional attention to the question of investment in the existing stock, the data available for thorough investigation of the behaviour of the private market in this important shere of housing production remains inadequate.

There are two sources currently available from which detailed information on expenditures by the private sector on housing maintenance repair: the Survey of Housing Units, 1974 and the Urban Family Expenditure Survey, UFES. The ability to obtain the tapes of individual records in the case of the SHU data is the main reason why the source was used in this study. In many respects however the UFES asks a more comprehensive set of questions regarding housing expenditure and were access to be gained to these files a great deal more could be learned (on a national level) than is presently available from the SHU tapes.

At the same time, the SHU survey does have long term advantages which are worth addressing. The SHU surveys were originally intended to be longitudinal, that is repeated interviews of occupants in the same original set of sampled dwelling units were planned. This is especially relevant in
light of the conceptual discussion in this paper which noted the importance of the length of occupancy variable and stressed the importance of a longitudinal perspective in any study of households repair decisions.

A longitudinal approach is appropriate because repairs in any one year are only a portion of repairs made by an owner during his ownership period. Moreover, the amount spent will vary by the number of years since purchase. It is desirable therefore to have more than one estimate of annual repairs for the same owner in the same dwelling units. If this can be achieved by replication of the SHU survey then at least one of the main drawbacks in current surveys of repair expenditure will have been at least been partially addressed.

Replicating the original SHU survey in the near future is not the only requirement necessary for this survey to be useful for housing maintenance and repair issues. As they stand, the questions on repair themselves are inadequate for anything but some very basic impressions - as this study has shown. Furthermore they repeat rather than add to questions asked in the already existing Urban Family Expenditure Survey.

There are at least two further questions which should be asked if the methodological problems raised in this paper are to be resolved. The first requirement is a detailed listing of actual repairs undertaken. These should be in such a form that they can be subsequently aggregated by the analyst into meaningful categories. For government policy purposes, meaningful may be defined in terms of the ability of various items of expenditure to be identified as those necessary to meet local housing standards. A second criteria might be that which will ensure the life of the repairs beyond a certain number of years. A third may be that which would ensure that a section of the stock re-
tains its relative position in the housing market as a whole.

Secondly in addition to knowing what repairs were undertaken it is desirable to know who carried out which repairs and the kind of remuneration involved. Whether this was unpaid or paid (contract) labour and some indication of materials costs should be indicated. The importance of the family as a labour pool in housing repairs and the changes in reliance on contract labour over the life cycle of the homeowner (as well as other attributes such as ethnic background) may turn out to be important in formulating housing repair and rehabilitation strategies.

The importance for program purposes arises from the need for government to anticipate under-maintenance and lack of repair in different sections of the stock in different geographical areas. Until we know what expenditures are made on what items with what degree of skill we will not be in a position to adequately answer one of the fundamental questions which lie behind the concern for repair expenditure, namely how long will a given item of repair, say a new roof or new siding, or new interior plastering, continue to provide adequate service. Only when some estimates such as these can be made (and they will probably be property type and age dependent) will we be able to evaluate the actual items that home owners choose in terms of their contribution to maintaining overall housing quality. Knowing the items of repair households actually choose to make may turn out to be just as important for government policy in this area as knowing which households are likely to make them to which houses.

Finally it should be noted that the SHU and Urban Family Expenditure Survey do not ask questions of landlords or absentee owners. In terms of level of deterioration of housing stock it may well be that their expenditures level are the most critical. Over half the dwelling units in Metropolitan Toronto for example are rented and yet at present there is no survey performed which
investigates the maintenance and repair practise of landlords. Much of this stock was built during the 1960s and the effect of physical deterioration may not be felt for a decade or more. It may be important however to plan at this time for the information necessary to evaluate the government maintenance and repair strategies which may well become necessary in that future period.
FOOTNOTES

A number of people kindly read an initial draft of this paper. In particular I wish to thank John Hitchcock for his comments. A number of his ideas feature in the text. Phil Brown of CMHC and Katherine Wilson identified weaknesses in a number of areas and I have benefited from their comments. Errors of omission and commission remain mine.

1. These last data provide the basis for governments' internal evaluation of the success of their own programs, for an example see Rostum, 197a and b. How these programs fair with respect to the absolute magnitude of the problem has tended to be evaluated primarily through the personal interpretation of local practitioners (for example see Peter Barnard Associates, 1976).

2. Toronto includes the Muncipality of Metropolitan Toronto plus Mississauga (town) and Port Credit (town). In 1971 Toronto defined in this way had a total of 343375 owner occupied dwellings (Statistics Canada, Cat 95-721).

3. A full account of the survey may be found in Statistics Canada, 1976, "Background Information on the 1974 Survey of Housing Units."

4. This same question was also asked of respondents who had moved recently with respect to their previous dwelling. This second set of data is not analysed in this paper.

5. Respondents were also asked to specify the type of repairs undertaken but responses to this question were not included on the available data file.

6. The term L in turn may be decomposed into the implicit price of labour, \( P \), times the quantity or amount of work done, \( Q \); \( L = (P \times Q) \). The estimate of time spent on repairs by unpaid labour \( (Q_u) \) is asked in the U.S. (The U.S. Commerce Publication (50-74, "Residential Alterations and Repairs"), but as Mendlesohn points out (1977), without knowledge of \( P_u \) an estimate of \( L_u \) is difficult to make.

7. The question of the capital labour ratio is complicated in this instance by the presence of labour 'selling' at two different 'prices': professional or contract labour may be assumed to have one price per unit of work. The price to be attributable to unpaid labour is problematic especially when such work may be performed for pleasure (a possibility which Mendlesohn for example (1977) is forced to explicitly ignore). Just how estimates of such prices may be obtained is beyond the selected scope of this particular study.

8. The relationship both of paid and unpaid labour and the composition affect of income may account for the fact that Kirwin and Martin found a generally weak relationship between level of expenditure and current income of head, some currently poor households having invested quite large sums in improvements during the period. The conclusion was that while income appears to be an important determinant of the propensity to spend on improvements, increasing income is unlikely to lead to greatly increased expenditure where other important factors such as age remain unchanged (Kirwin and Martin, 1972:126). Failure to explicitly compute the value of unpaid labour may have complicated interpretation of results in this instance.
9. The boundary of the Toronto area is indicated in footnote 2. With respect to the Toronto survey area a sample of 3410 dwelling units was planned and a final response total of 2709 was drawn, giving a response rate of 85.91 percent. The analysis is confined to dwelling units owned by their occupants and hence a maximum sample size of 1307 is available.

10. The strata employed in drawing the SHU survey were defined according to age of head category, household income and tenure status. Thus if the aim is to estimate proportions in those categories, then it is appropriate to weight the different categories of these variables. In the case of aggregate expenditure it is the population estimates which are of interest and weighting is carried out.

11. Since a sample is being used some recognition of the sampling variability associated with certain key estimates of levels of the maintenance and repair expenditure is desirable. However since this paper is only a preliminary statement these confidence limits have not been calculated. In this respect, see "Publication Policy and Release Policy" in Statistics Canada, 1976, p. 15.

12. Mendlesohn (1977) shows a very similar distribution based on national U.S. evidence (Figure 1, p. 463, op. cit) with respect to a six month period. He noted that "almost one half of the sample of households decided to make no expenditures." (Mendlesohn, 1977, 462). Similar response rates from a very similar question are reported by Statistics Canada in their periodic Urban Family Expenditure Survey. In 1972 for example the percentage reporting repairs for the previous year in the Toronto area was 43.1 percent as compared to 45.2 percent reported in the SHU survey (Statistics Canada, 1975, Table 19 p. 34).

13. Since different strata were sampled with different weights there are slight variations in some of the percentages. While such variations are recognised, most of the results in the remainder of this study will be presented directly in terms of the sample numbers themselves. Hypothesis testing in the study involves comparing number of households with different amounts of expenditure within a given age or income category. The actual distribution of household over the different categories of the variable is not of special interest and hence unweighted sample figures will be used. Furthermore it is the chi-square statistic which is used in carrying out these tests and it is therefore appropriate to use the individual sample figures.

14. There is also a tendency for lower income groups to pay a higher proportion of their home ownership costs on repairs (over 20 percent) than is true for most other groups especially high income families (under 20 percent) (Statistics Canada, Cat 62-541, pages 78-79). In the same survey Statistics Canada computes the net change in assets and liabilities by family income class for eight cities, and in so doing produce a series on additions and improvements to the dwelling unit. This series also shows a rise in average absolute expenditure by income class but the propensity for high income groups to spend more (absolutely) rises faster in this series than for repairs alone. Moreover, the percent actually reporting such expenditure in one year increases from under 5 percent in the case of families under $7000 income to between 10 percent and 25 percent in those families receiving over $12,000 per annum (Statistics Canada, Cat 62-541, Table 30, p. 156-157).

In a model of consumer expenditure on a time series (1922-66) of house maintenance and repair expenditure in Canada by Schweitzer (1969:66-7) showed that while such expenditure depended on income, variations in such expenditure was relatively more responsive to changes in relative price of that item in relation to other goods and services. One of the implications of the importance of price is that households are likely to postpone repair expenditures depending on the relative
temporal pattern of price changes.

15. For example certain buyers may not command the wealth necessary to borrow at rates which will allow purchase of dwellings which approximate some desired level $q^*$. But this is probably not the only possibility. Some owners may choose to switch the allocation of some current income from interest payments on higher second mortgages to the hiring of contractors to make repairs on a lesser property.

16. This argument would also be modified in the case where the mortgage contract contains an obligation for repairs to be made and the financing provisions allow for that. These and other real world features of the overall question can easily be introduced formally into the analysis.

17. For completeness the effect of the need to sell a property on repairs made should be mentioned. Some repairs may be carried out just prior to marketing of the property. In this case the returns are confined solely to expected increases in market price rather than any additional housing consumption.

18. However Mendlesohn was able to show that when duration of occupancy was entered in a logit model alongside other variables such as age and income etc, that "the likelihood of nonzero expenditure (did) decline with the duration of occupancy" (Mendelsohn, 1977; 464). However this same hypothesis with respect to the level of expenditure could not be sustained; nor could the reverse (Ibid). For reasons outlined in Figure 3 and 4 it is likely that Mendelsohn's model is misspecified. The appropriate way of evaluating length of occupancy was not possible with the cross sectional data at his disposal. The problem of measurement error in the dependent variable is very similar to that discussed with respect to the SHU data. And such measurement error and the length of occupancy variable interact in a manner which is not explicitly addressed in that study.

19. In a univariate analysis like that conducted here Kirwin and Martin found length of occupancy to be an important variable. They suggest a cyclical pattern of expenditure. While the great bulk of expenditures were undertaken by those who had been resident in their present homes for more than 5 years, among those who were resident for only 5 years or less there was a much greater probability that improvement works would be undertaken during the first year of occupancy (Kirwin and Martin, 1972:93, n=85).

20. In 93.85 percent of cases expenditures made referred to one dwelling unit. Where the respondent indicated that the expenditure referred to more than one unit, the amount was divided by the number of units to which it referred (Survey of Housing Units, 1977:5).
REFERENCES CITED


____. Cat. 64-203. Building Permits (Annual).


____. 1976. Background Information on the 1974 Survey of Housing Units.