New Dwelling Units
From the Existing Housing Stock:
A Location Model

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ABSTRACT

The conversion of dwelling structures to produce more smaller dwelling units or fewer larger units from a given residential property is a widespread means of supplying 'new' housing in different size and tenure markets within the inner city. In this paper a conceptual model of conversion is presented in which different income groups compete for available structures. The process of conversion is examined empirically using a random sample of nearly 800 residential properties drawn from the inner urban area of Metropolitan Toronto. The relative importance of changes in demand for different sized dwelling units as well as for different dwelling structures and neighbourhood characteristics is estimated. All three factors are found to be influential in accounting for geographical variations in conversion rates but they differ in relative importance depending on the type of conversion undertaken. The probability of conversion is estimated separately for single and multiunit structures.

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INTRODUCTION

The conversion of existing residential structures into a larger number of smaller dwelling units has historically been one of the principal sources of an additional supply of dwelling units for low income groups in the inner city. However, in the last decade in particular, conversion of existing multiunit structures into smaller numbers of larger dwelling units has also served as a major process by which the private market has supplied inner city housing to higher income families (Gale, 1979). The result in many neighbourhoods is a direct competition between groups of low income households and single high income households for the same building structures.

At the same time there is considerable uncertainty as to which of the above outcomes is most probable at any given location and at any given time within the urban area. This study provides a conceptual framework and a research design which together allow certain market factors to be incorporated into a location model of the probability of residential conversion. The probabilities are estimated using a multinomial logit model applied to a set of sites within the city.

Our point of departure is the contiguous neighbourhood expansion model developed by Bailey (1959) and the microeconomic principles of conversion employed in much of the conversion literature (Section 1). The present approach to the study of conversion departs from the previous literature principally in the way in which it focuses on the purchaser as a central actor in the conversion process. This and other aspects of the approach are introduced in Section 2. The focus on the bidder as converter is used in a general specification of a model of the location of conversion in Section 3. The research design is described in Section 4 and the variables used in specific applications of the model are introduced in Section 5.

The applied model examines the effect of the extension of a mass transit line through a major sector of low and moderate income housing in Toronto on the probability of conversion activity in neighbouring locations. The results are reported in Sections 6 and 7 for single unit and multiunit residential structures respectively.
SECTION 1. THE BAILEY MODEL

Conversion of residential structures is likely to occur when purchasers wanting dwelling units of different size and/or quality from a given structure outbid others who would keep the dwellings in their existing state. Such increases or decreases in the size and/or quality of dwelling units usually imply occupancy by a succession of households with different socio-economic and demographic characteristics. Generally speaking, with respect to a given location, the greater the income of the households, the larger the size and better the quality of the dwelling unit(s) that will be demanded. Muth (1968) has described the process leading to reduced size and quality in the following way:

The condition of dwellings inhabited, as well as the amount of space per person and other features, may be viewed as inputs into the production of a commodity called housing. Hence, anything which reduces the quantity of housing demanded, such as a fall in income per family, or a rise in the relative price of housing services, might be expected to reduce the derived demand for housing quality and for space. As a consequence, one would expect that dwellings would decline in quality and that more persons would occupy a given floor space or number of rooms.

(Muth, 1968:307)

As Hoyt observed, neighbourhoods characterized by similar occupancy patterns are usually spatially concentrated and expand through the conversion of structures in contiguous areas (Hoyt, 1939). What happens at the border of such areas therefore is of special interest in understanding both neighbourhood changes and shifts in the supply of housing. This approach to conversion activity is taken up in the argument presented by Bailey (1959). Bailey's approach focuses on changes in the price of housing services at the border of neighbourhoods separating two competing socio-economic groups. As restated by Muth,

"With respect to an area of 'slum' housing on one side and 'non-slum' on the other" there is a distribution of prices which ensures locational stability. However "if prices on the slum side of the boundary exceed those on the non-slum side by interest on the costs of conversion or more, the boundary will tend to shift towards the non-slum side (if different properties are held by separate owners)."

(Muth, 1969:132)
The key parameters in such a model are the price of housing services (net of operating costs and an allowance for risk) in relation to the costs of conversion. It is the changing relationship between the expected returns and anticipated costs of conversion that is responsible for the dynamics.

The Bailey model is useful in that relative changes in prices in the interior of the neighbourhood and at the boundary can be used to anticipate the direction of expansion of whichever socio-economic group is of interest. Moreover, once boundaries have been identified, the direction of conversion in relation to the spatial pattern of price differentials can be empirically tested (Bailey, 1966). The model also forms the basis of the subsequent arbitrage model of neighbourhood change employed in extensive empirical analysis reported in Little et al. (1975).

When it comes to generalizing the Bailey model, however, particularly to other housing market contexts, a number of difficulties can arise. The notion of the boundary, which is central to the model, is based on an assumption about the mutual avoidance of social groups, in particular on the supposition that "higher income persons have more of an aversion to living in the vicinity of slum dwellers than other slum dwellers" (Muth, 1969:131), a point also stressed by Hoyt (1939) in his account of the sectoral pattern of residential development in American cities. However, unless the society involved is exceedingly pluralistic, identifiable geographic boundaries are likely to involve only a relatively small proportion of the low income population. This is an important limitation of the model if the central concern is the provision of housing for low income groups as a whole. Furthermore, the existence of a boundary separating slums and non-slums may be a rather restrictive representation of a more general, and geographically more diffuse form of housing competition. In practice, the great majority of households lies between the two extreme positions which are required in Bailey's model for clear geographic boundaries to develop.

The point is that if one removes the poor and wealthy and the mutual antagonisms which create the distinct types of spatial submarkets analyzed by Bailey, there still exists a large proportion of low and middle income households with sufficiently wide differences in income and housing require-
ments to generate the kinds of competition for residential structures which result in conversion. This is particularly true in the case of competition between tenure groups where similar dwelling structures can serve as inputs to either rental or owner occupancy (or combinations of both).

In addition, the apparent lack of a strong effect of mutual avoidance, characteristic of residents in many of the Canadian (as opposed to most American) inner cities, may actually be associated with an intensified demand for existing dwelling structures. Hence prices faced by low income households may be higher according to the degree to which spatially defined submarkets do not exist, for generally speaking, structures outside such areas are bid for by a wide range of income groups. The relative lack of a context in which to apply the Bailey model may in fact imply a situation in which housing provision for low income groups may be of greater concern since, at least in the spatial submarket case, the avoidance of certain areas by higher income groups may have offered some "protection" to low income buyers. ²

The relative absence of distinct geographic boundaries and of spatially-defined housing submarkets also means that competition within the housing market is more likely to occur at the level of the dwelling structure rather than over entire residential areas or neighbourhoods. Thus, if we argue from the perspective of the supply of low income housing in the urban area as a whole, rather than that confined to relatively isolated submarkets, then we are left with a model in which the conversion of dwelling structures is some function of the relationship between the price of housing services and the costs of conversion as in the Bailey model, but without the connection to a geographic boundary. In such a market context, conversion activity becomes a city-wide process.

Alternative Approaches to the Study of Dwelling Conversion

Not all those who have studied conversion have done so using the Bailey model, in part because of the lack of clear geographic boundaries in the
housing market under study, but also because of the interest in intra-
submarket or within neighbourhood aspects of the process. A few studies have, however, taken a city-wide approach and employed different conceptual frame-
works. The conventional economic view derived from micro-economic principles is represented by Bradbury's (1977) study of supply changes from existing
housing stock (in Boston, U.S.A.). Bradbury summarizes the argument as follows:

Owners of structures-and-land real estate parcels compare the
operating costs and revenues of the current use with the incremental
capital costs, operating costs, and revenues of uses to which
the property could be converted... If the incremental revenue of
the best of the conversion options exceeds the incremental costs,
the conversion will occur...

(Bradbury, 1977: 8-9).

This perspective reflects an established approach to conversion which
suggests that optimal conversion should take place when the net annual return
from a new development just comes to exceed the net return in some existing
use (a derivation which has allowed useful analysis of public policy options;
see Nowlan, 1976).

While this more detailed focus on the economic basis of conversion is
instructive, there are difficulties in using the ideas to interpret observed
behaviour in the market. One of the more inhibiting in this writer's view,
is the implicit assumption that the owner is immobile, that he somehow comes
with the property. The incumbent owner is assumed to have already bought the
property for which conversion is one option and therefore the decision to
convert depends entirely on the economic context prevailing after the purchase
of the structure. The theory implicitly assumes that purchase costs are sunk
and therefore irrelevant to the micro-economics of the conversion decision.

The conventional economic approach to acquisition costs as sunk costs
may be satisfactory in certain kinds of economic modelling, however, the view
taken here is that the costs of purchase are an important consideration in
accounting for where and when residential conversions occur. The reason why
this is so important in the housing market being studied, rests on the ob-
ervation that conversions which have the greatest effect on the value,
size, and quality of the dwelling units offered in a given structure (and hence on the occupancy characteristics of the property) tend to be made by recent purchasers. One can infer from this relationship that such conversion decisions are commonly made in conjunction with the decision to purchase the property. In this situation, as far as the decision to convert is concerned, the purchase price is an integral cost component of the decision to supply a given type of housing.

This argument is made in full recognition that not all decisions to alter the supply of housing from a property are likely to be made prior to purchase. In some cases such decisions are made by owners who may have purchased the property many years previously, but whose conditions or attitudes have changed. Nevertheless, in terms of sensitivity to changes in the housing market and the relative magnitudes of the investment, new buyers are likely to be the most influential in the conversion process.

SECTION 2 AN ALTERNATIVE CONCEPTUAL FRAMEWORK

The emphasis in this study on the purchaser as a key figure in the conversion process leads directly to a focus on the bidder as someone who is actively searching for a residential property to purchase, and specifically on the likely distribution of those among the bidders for any given property in a particular location who will undertake conversion.

In a competitive housing market bidders with different dwelling unit size and quality preferences may evaluate the same structure. In this way, a given structure may serve as a potential input to the production of one of several kinds of (one or more) dwelling unit(s). Which of these several supply consequences will result from any purchase decision is the critical question, for among the bidders for a property on the market will be those whose demand for a particular kind of housing will lead to a conversion of the property. On the other hand, there are those who will use the present dwelling unit in its present state, without change. For convenience, the first group may be termed converters and the second, non-converters.
Differences in the Demand for Residential Structures

The variations in demand for a given housing structure by different income groups may be represented as in Figure 1. In this case the supply schedule $S$ refers to a single building structure at any given location and it will of course be price inelastic. Thus, in this discussion we distinguish between the supply of structures, which serves as the basic input to the dwelling unit (or units) and the conventional meaning of supply as a stream of housing services. By comparison, the supply of housing services may be quite price elastic as owners alter the internal arrangement or the components of structures to meet changing housing requirements (Ozanne and Struyk, 1976).

The demand for structures nevertheless derives from the demand for housing services and the bids therefore reflect the ways in which different types of housing can be supplied from a building. The bidder for a given structure may be either the future owner-occupant or a future absentee owner (whose bids reflect expected demands for housing by other, renter, households). In either case, the possible use of the structure will be reflected in the bid price.

The differences in bids and the reasons for these differences are instructive. In our illustration, Figure 1, which is constructed with the case of a single family structure in mind, we suggest that a single low income household could only bid $P_L$ as compared to $P_H$ offered by the high income single family household. (Possible differences between income groups in the slopes of their demand functions are ignored at this point). However, by converting the single family structure and sharing the existing space, low income households collectively ($L_C$) may be able to outbid the single high income household; that is $P_{L_C} > P_H$.

The collective bidding process may operate in at least two ways; a lower income purchaser may subdivide the structure and rent part of the unit, or an absentee owner may subdivide and rent all of the space to two or more households. In both cases the density of use of the structure changes with subdivision together with the income and demographic composition of the
Figure 1.

The Demand for a Residential Structure at a Location

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\begin{align*}
  & \text{Figure 1.} \\
  & \text{The Demand for a Residential Structure at a Location}
\end{align*}
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occupant households.

Physical subdivision of a structure, however, is only one way in which succession can take place. Two more commonly documented cases may be referred to under their popular names as filtering and gentrification. In the filtering case, the relative quality of housing and neighbourhood falls so that other, usually newer, units become more favourable alternatives. In terms of Figure 1 the demand by higher income single families for housing capital in the form of older structures falls to \( P_{H1} \) which in turn may allow lower income households to succeed without reductions in the amount of space occupied per person or changes in the number of dwelling units in the structure.

In the second and more recent, but less widespread case, often referred to as gentrification (or in some cases upward filtering of dwelling units), higher income households outbid collectives of low income households for a given structure; \( P_{H2} > P_{Lc} \). In such cases two or more dwelling units in the structure may be merged and the dwelling returned to single family use.

Although often analysed separately, the patterns of residential conversion which may accompany such changes in demand as depicted in Figure 1 can each be traced to market competition involving different socio-economic groups in several different parts of the same urban area over the same period of time. Our central question therefore is how can changes in demand, which lead to different types of conversion, be anticipated with respect to any given location and how do differences in structures themselves inhibit or encourage conversion. While conversion has been discussed above in general terms, from this point on our central focus will be on changes in the size and number of dwelling units in the stock. These conversions are referred to as subdivisions and as mergers.

Towards a Model of Differences in Bids by Converters and Non-Converters

Having introduced the fact that a range of bids may be received for any given residential structure on the market and that in turn these bids reflect different anticipated uses of the structure, the central question now becomes, why did the successful purchaser select this particular type of structure in this location as opposed to any other on the market? In
particular, why were buyers who converted able to outbid non-converters for the structure?

Bids that are offered reflect the bidders' perceptions of the demand for housing from a given structure in relation to their resources and the anticipated costs of conversion (if any). Thus, knowing the likely demand for housing in an area, together with measures of costs for different types of property conversion, would be a starting point for an analytical model of the location of conversion activity within urban areas.

It is this starting point which has led some researchers to attempt to measure the demand for housing in an area as an input to their models of conversion. However, in these studies the characteristics of the occupants, together with the rent levels following conversion, are used as measures of demand. But, in terms of an explanatory model of the spatial patterns of conversion activity, using the characteristics of the occupant following conversion as an argument in accounting for conversion, amounts to circular reasoning, for it is the demand characteristics themselves (and the alternative types of housing supplied) which has to be explained. The characteristics of the occupants following conversion amount to an elaboration of the dependent variable and therefore ought not also to be part of the argument or set of explanatory variables.

One of the essential features of the argument, however, is the anticipation of changes in the demand for housing from any given set of structures. In other words, changes in demand itself have to be modelled as part of the model of conversion. This is the approach taken here. Since the focus is on the purchaser and the character of the market at the time of sale, we are implicitly assuming that the demand which may or may not provide a stimulus for conversion, originates from circumstances not immediately associated with present occupancy characteristics of the structure. Rather, since these will be dispelled at the time of sale to the new owner, the key explanatory variables are likely to be exogenous to the structure itself. It is to these exogenous or market factors that we now turn.

The implication of the preceeding viewpoint is that the problem of constructing a location model of residential conversion reduces primarily
to a search for variables which are causally related to the distribution of bids by converters and non-converters for structures in a given location. There are at least two possible approaches which can be taken in constructing such a model. One is simply to examine, through trial and error, a wide range of possible variables associated with conversion activity at the particular locations in question and come up with a matrix of correlations. This is a useful exploratory approach and it has been taken by McCann (1975) for example in his studies of conversion through the use of ecological correlations.

A second approach is to attempt to estimate the effect of specific exogenous factors on the distribution of bids for structures at a given location. This amounts to testing specific hypotheses about the effect of individual exogenous variables when the structure characteristics and more general locational correlates are employed as controls. This is the approach adopted in the empirical analysis below. In the discussion to follow we take a specific case of how the distribution of bids by converters and non-converters may have been altered by an exogenous event in such a way as to bring about residential conversions of a particular kind. The exogenous event examined in this application is the extension of a mass transit subway line through a cross-section of low to middle income neighbourhoods in the inner city. With this specific application in mind we turn now to a more formal general statement of the model used.

SECTION 3 A FORMAL STATEMENT

Residential conversion at a given location is indicative of the fact that the demand function of one group of housing consumers with respect to a given neighbourhood type has changed over time relative to that of another defined group. In this section we suggest several general factors which can alter the demand for housing at a given location by any given group.

Three factors are likely to dominate changes in demand for structures by any given socio-economic group: changes in the resources of the bidders involved (y); the costs (c) of converting alternative properties to a given
supply state (where \( c \geq 0 \)); and changes in the price (\( R \)) of equivalent housing from alternative (\( w \)) structures.

Thus, conversion may be discussed abstractly as a change in a residential structure from state \( i \) to state \( j \) (where \( i \neq j \)) where the states are measured on some dimension such as number of units. This would occur if the resources available to bidders with needs of type \( j \) are greater than those seeking the property in the \( i \)th state. Such resources include not only current income but also wealth and the ability to command mortgage finance. The amount which any bidder is willing to pay depends of course on expected net returns which in turn depend on the area involved, and on the costs of conversion, \( c \). In the two-state supply model discussed here, where we consider the dwelling unit to be in supply state \( i \) at the beginning of the period, conversion costs will be greater than zero only for \( j \) type bidders. Depending on the characteristics of the residential structure and the type of housing required, conversion costs will thus differ for different bidders.

There are typically many properties available to bidders within any given neighbourhood and the decision to bid for a particular property will depend upon the market price (\( R \)) of alternative properties (\( w \)), that is \( R_w \). Included in the real price of \( R_w \) is the cost of converting such properties if they too have to be converted from state \( i \) to meet the bidders demand for housing. Thus, with respect to any given housing structure we can write the following functional relationships:

\[
\begin{align*}
(1) \quad a \quad R_j^* &= f_1 (y_j, c_j, R_w^j) \\
             b \quad R_i^* &= f_2 (y_i, R_w^i) \quad ; \quad c_i = 0 .
\end{align*}
\]

where \( R \) is the bid price, \( R_w \) is the known price of the next best alternative housing structure and \( y \) and \( c \) are the bidders' resources and costs of conversion as defined above.

By definition the \( i \)th property will be converted if \( R_j^* > R_i^* \). However, when we consider the likely future state of dwelling structures in any location, the relative bids of \( i \) and \( j \) are generally unknown, conversion itself can only be stated as a probability. This probability can be
estimated nonetheless as a function of the kinds of factors likely to affect the respective bids of convertors and non-converters. These include factors likely to affect the relative resources of any two or more bidders for structures at a given location, the costs of conversion from state i to j and the relative prices facing the i\textsuperscript{th} and j\textsuperscript{th} bidder for alternative housing available from structures in other locations. Thus, our general model may be written as:

\begin{equation}
(p_{ij})_{t_0,t_1} = f_3 (y_j - y_i, c_i, R_j - R_i)_{t_0}
\end{equation}

where \( p_{ij} \) is the probability of a given structure being converted from state i to state j and \( f_3 \) is a function to be specified and estimated.

The time subscripts \( t_1 \) and \( t_0 \) refer in an important way to our approach and focus on the role of the purchaser in conversion activity. The probability of conversion \( p_{ij} \) occurs within some time period following purchase at \( t_0 \), and before any subsequent or future sale of the structure at \( t_1 \). Since most conversions are made soon after purchase, this period after \( t_0 \) may be quite short, say in the first year or two of what is typically an eight to ten year holding period. Our emphasis on the purchase decision implies that the influence of the explanatory variables occurs up to the time of purchase \( t_0 \), since such factors as resource availability, the costs of conversion and the relative price of other structures elsewhere pertain principally to the period in which bidding occurs, and by assumption do not extend into the occupancy or holding period \( t_0, t_1 \).

At the level of the individual residential structure, conversion of a given type is observed as a discrete event; it either occurs (over the period \( t_0, t_1 \)) or it does not. Furthermore, any one of a number of different types of conversion (including no conversion) may be selected by the purchaser. One of the aims of the following conversion model therefore is to develop a methodology which is capable of predicting to which use, among a set of possible alternative uses, a given parcel or structure may be converted. The following section turns to the estimation procedure for such a model.
The Estimation Procedure

The act of conversion, as noted above, is a discrete occurrence with subdivisions or mergers either taking place or not. The explanatory variables on the other hand may be either discrete or continuous. One particular form of probability model, the multinomial logit model, is most appropriate to handle this kind of estimation (Wrigley, 1975), although to date its application does not appear to have been extended to an analysis of the kind of locational problem investigated here.

In the case where conversion occurs, i ≠ j, and using the standard logit model, the probability of conversion may be written

\[ p_{ij} = \frac{e^{X\beta}}{1 + e^{X\beta}} \]

where \( p_{ij} \) is the probability of conversion of a residential property from state i to j and \( X \) is a vector of independent or explanatory variables.

Or, for the case where no conversion occurs, that is, i = j,

\[ 1 - p_{ij} = \frac{1}{1 + e^{X\beta}} \]

The estimation of the parameters equation (3) and (4) requires the use of direct maximum likelihood methods. The likelihood function for the model in equation (3) is

\[ l = \prod_{i=1}^{N} \frac{e^{X\beta}}{1 + e^{X\beta}} \cdot \prod_{i=1}^{N} \frac{1}{1 + e^{X\beta}} \]

In practice, it is the log of the likelihood function which is maximized and the aim is to find that vector of coefficients \( \beta \) at the point where \( \log_e l \) is at a maximum.

The binary logit model above is really only applicable in the case where we consider a single or unidimensional conversion, such as in the subdivision of a single unit property, since in such cases the structure is either subdivided or it is not. There is greater generality in the case of conversion within or to multiunit properties. If we focus simply on a change in the number of dwelling units, for example, then the conversion
of this kind of property may involve three possible outcomes: 1) further subdivision, 2) no change and 3) the merger of two or more units into a fewer number.

With respect to subdivision and merger, subscripts i and j refer to the number of dwelling units in the property before and after the period during which conversion can occur, \( i = 1, 2 \ldots I; j = 1, 2 \ldots J \). Hence for the case of the multiunit residential structure (i.e., \( i \geq 2 \) at \( t_0 \)), \( i > j \) denotes a merger of two units over the holding period, \( i = j \) represents no change and \( i < j \) indicates further subdivision. In such a case, there are \( N_1 \) residential properties which were merged (\( i > j \)) over the period, \( N_2 - N_1 + 1 \) properties which were subdivided (\( i < j \)) and \( N_3 - N_1 + 1 \) which remained stable (\( i = j \)). Hence the likelihood function for the multi-unit case is

\[
\ell = \frac{N_1}{\Pi} \left( \frac{X^\beta_i \cdot e^{i > j}}{1 + e^{i > j}} \right) \cdot \frac{N_2}{\Pi} \left( \frac{X^\beta_i \cdot e^{i < j}}{1 + e^{i < j}} \right) \cdot \frac{N_3}{\Pi} \left( \frac{1}{1 + e^{i > j} + e^{i < j}} \right) 
\]

and once \( \ell \) is maximized, a vector of coefficients \( \beta \) is obtained for subdivision with respect to no change and for mergers with respect for no change. These coefficients reflect the magnitude of the various independent variables \( X \) which we argue below deter or attract bidders to particular properties.

SECTION 4 THE RESEARCH DESIGN

The conceptual framework in Section 2 offered a way of thinking about the residential conversion process while the logit model (Section 3) provided a means of estimating the key parameters of that process. Four methodological
features remain to be discussed: 1) the conversion measure, 2) the sampling design, 3) an explanation of the way time is handled in the analysis and 4) the data itself.

The Conversion Measure

Conversion as a descriptive concept has been used in a number of different ways. Lipstein, for example, in an early paper (1956) used the physical addition of dwelling units as a measure of conversion activity, as did McCann (1975). In a departure from physically-based definitions, Brown (1975) and Peddie (1978) identified numbers of separate households in a structure and whether they own or rent. These two criteria were then used to define 'occupancy-based conversion', that is, conversion based on the type of occupancy rather than on the presence of specific physical characteristics of the dwelling structure.

In this study we are primarily interested in changes in the physical dimensions of dwellings and only address changes in tenure indirectly. More specifically, the focus is primarily on changes in the size and number of dwelling units in residential structures of four units or less. Such changes are brought about either through subdivision or mergers. Subdivision is defined here as the division of an existing dwelling unit into two or more units, and merger as the physical combination of two or more dwelling units within the same structure into a single dwelling unit. The actual measure of the number of dwelling units is based on a comparison of the number of kitchens in the structure at the time of purchase and again at the time of sale. This operational definition is not perfect because some kitchens in a dwelling can remain unutilized as such, however this occurrence is likely to be minimal. More importantly, the measure has the advantage that it is consistent with the definition of a dwelling unit used in the Census (which is based on the presence of common dining facilities) and it is relatively simple to apply.

The Sampling Design

The number of new dwelling units resulting from the subdivision of existing units is a relatively small proportion of all dwelling units supplied by the housing market as a whole in Canada. However, in inner urban areas conversion rates can be quite high. For example, over a period of ten years from 1961
to 1971, over one third of all residential properties in the Toronto inner urban area containing four dwelling units or less were converted from supplying dwelling units in one size category to those in another. Nearly twenty-five percent of properties had one or more removed.\(^\text{13}\)

The relatively higher level of conversion in the inner city was one of the two considerations which led to the choice of the boundaries for the study area and the sampling design. The second was the decision to use the construction of the east-west subway extension through the inner city as the 'exogenous' event whose influence on the demand for alternative housing could be studied for its effect on conversion activity.

A two stage stratified sampling procedure was employed. All residential properties of four units or less within an area delimited by the pre-1947 housing stock of Toronto, and which remained standing over the period of 1957 to 1973, were listed for sampling (Aerial photographs were used in the listing). Eighteen strata were defined for properties within this area, based on walking distances from the new subway stations, the period of construction and on median property value. A paired selection sampling design (Kish, 1965:223) was then used to define sampling fractions for the nearly 800 properties selected for the analysis.\(^\text{14}\)

Conversions on a street may not be independent events. As Davis and Whinston argue (1969), conversion of one property may influence the probability of conversion of a nearby property. For this reason, a spatial filter was applied in selecting the sample. The second stage of the sampling procedure involved the selection of dwellings within previously sampled paired clusters of dwelling units. These clusters identify sets of dwellings on a street. In order to reduce the chances of spatial interdependence (autocorrelation) the interval employed in the systematic sampling of units from each street was set so that units were chosen that were located more than a certain minimum distance away from one previously selected. In preventing units that neighbour one another from being selected, the possibility of spatial autocorrelation in conversion behaviour was reduced. At the same time, by beginning the selection of dwellings on a street at randomly selected locations, the requirement of an equal probability of selection remained intact.\(^\text{15}\)
Both single and multiunit dwellings were sampled. The distribution of single-family units sampled over the study area and in relation to the (Bloor) subway extension, is shown in Figure 2. The spatial distribution of subdivision activity is also shown (Figures 5 and 6 show the distribution of multi-unit properties and associated subdivisions and mergers). The horizontal dotted lines in Figure 2 show the defined walking distance used to measure the immediate catchment area of the Bloor subway. Initially circles of equal diameter were drawn around the new stations but because of considerable overlap these areas were subsequently collapsed into the rectangular 'subway catchment area' shown in Figure 2.

The Treatment of Time

As outlined above, the present approach to residential conversion focuses on the roles of the purchaser and identifies conversion according to observed changes in the property at the beginning and end of the period in which the new owner held that property. In order to ensure a relatively common temporal context, the population of purchasers was defined according to dates of purchase and sale.

Two criteria governed the selection of time intervals for the study. One was a desire to make maximum use of the data available (the complete Multiple Listing Service files cover the period from the late 1950s to 1973), and the second was to ensure the use of ownership periods which reflected the population average for length of ownership. It turns out that by randomly selecting properties listed by strata from the defined population, which had holding periods consistent with the population average, we were able to obtain a representative sample of marketed properties both over time and by location. Furthermore, for reasons discussed in more detail elsewhere, this design also enabled generalizations to be made about all residential properties listed (Morrison, 1978, Appendix 4.4 to 4.6).

The purchase period itself (t₀) therefore defines a cohort of buyers. In this case, t₀ refers to those buying between the years 1957 and 1964. The distribution of purchases over this period is shown in Figure 3a as are the years over which these buyers sold (t₁), 1968 through 1973. The resulting holding periods (t₀ to t₁) shown in Figure 3b extend from as few as four
Figure 2. The Location of Sampled Single Unit Properties in the Toronto Inner Urban Area.

Subdivisions occur over the period 1957 to 1973.
Figure 3
The Distribution of Purchase and Sale Dates and the Duration of Holding Periods

a) Purchase and Sale Periods

b) Holding Periods $t_0$, $t_1$
years (constrained by the sampling design to avoid the inclusion of purely speculative holdings) to as many as sixteen years. The average holding period, however, is consistent with the overall average for the inner city owner-occupied population of between eight and ten years. 16

The Data

When a property is placed on the market, it is usually inspected by a selling agent who takes an inventory of its physical characteristics. At some future date the property will be marketed again by a subsequent owner and another inventory taken. A comparison of the two inventories allows for a variety of measures of physical change in the characteristics of the properties involved to be constructed.

The data resulting from this information comes primarily from the complete set of records of the Toronto Real Estate Board's Multiple Listing Service (MLS). This advertising service includes between forty and sixty percent of all sales and provides a sampling frame for all residential units. The frame is unbiased except for a slight under-representation of the upper value quartile of the property market (Morrison, 1978a: Appendix 4.4).

SECTION 5 VARIABLES AND SPECIFICATION OF THE LOCATION MODEL

The conceptual discussion and the details of the research design outlined above have provided a context in which to discuss a specific application of the model. The application amounts to a test of a specific hypotheses regarding the effect of an event which is exogenous to the set of sampled dwelling units, but whose influence on the market is to alter the distribution of bids for certain properties. Depending on the costs of conversion and other factors, converters and non-converters are expected to be attracted to certain locations and building structures according to the resulting changes in local market conditions.

There are two conceptually distinct issues which bear on the relative shifts in the balance of bidding power generated by the construction of a subway line through a residential area: 1) the different initial degrees of reliance on mass transit among different income groups, and 2) the existence of different degrees of response to changes in travel time among those groups.
In terms of equation 2 above, the specific question being asked concerns the relative marginal effect of the bids made by type i and j households for subject properties following a change in relative transport costs from main centres of employment to the subject property compared with the changes in travel cost to alternatives \( w_i \) and \( w_j \). It is argued that because of changes in travel time afforded by a mass transit line, the relative accessibility of the subject properties is altered with the result being a change in the relative distribution of i and j bidders in the market (for properties within the subway catchment area). More specifically, it is argued that the dependence of low income groups on public transit facilities is greater than that for higher income groups, since higher incomes allow greater bidding power for increased use of private (and for the most part faster) forms of transport, especially the automobile. Hence the improvement of such a transit facility is expected to have a relatively greater marginal effect on the location decisions of low income groups.\(^{17}\)

For low income bidders, or more generally those demanding small dwelling units, the marginal effect of constructing the subway will be to make properties neighbouring the subway more attractive than the others outside the catchment walking distance area which normally would rank as alternatives to this class of bidder. On this basis, single and multiunit properties located within walking distance of the new stations are expected to show a higher probability of subdivision or decreases in dwelling unit size than are properties outside the catchment area of the subway extension.\(^{18}\) The variables WALK1 and WALK2 and SW1 and SW2 are used to measure this distance-decay effect and are defined operationally below.

The completion of the Bloor Street subway line from Keele to Woodbine in 1966 is shown in Figure 4 together with other extensions to the entire subway system (to 1974). The approval of the Ontario Municipal Board for construction of the new line was given in 1958 and construction began four years later in 1962, well before its opening in 1966. Information about the new line accumulated throughout the period over which bidders for the sampled properties entered the market. As a result, as has been shown elsewhere, residential property values rose several years before the final opening.\(^{19}\) Therefore, although fewer bidders were expected to compete for such properties
Figure 4

The Toronto Subway System. Periods of Development to 1974

Subway section and date of opening

- Yonge St. (Union Sta. to Eglinton), 1954
- University Ave. (Union Sta. to St. George), 1963
- Bloor (Keele to Woodbine), 1966
- Bloor extensions: east and west, 1968
- Yonge St. extension to York Mills, 1973
- Yonge St. extension to Finch, 1974

*The effects of the extension is analysed in the text.

in later years because of higher prices, for those that do compete the pressure to subdivide property for revenue purposes is expected to be greater. This is because the higher prices of properties marketed closer to the date of subway construction reflect the returns to conversion expected on its opening. This, in turn, makes it less likely that bidders who are non-converters will be successful in obtaining the property. For these reasons a timing variable, YRLIST1, the year of purchase, was added. Our expectation regarding this time of purchase variable is that the sign be positive with respect to the probability of subdivision.

There are of course other factors which affect the decision of converters to purchase a property and prominent among these is likely to be expected costs of conversion. There are two issues here: those costs which may be defined in dollar terms and those which reflect legal restrictions such as zoning which inhibit, if not totally prevent, certain types of residential conversion, especially subdivision. The components of these two different kinds of costs need to be elaborated.

Since subdivision involves a physical act of producing additional dwelling units from an existing property, the costs involved may be expected to reflect both the degree (the number of units) and the ease with which rooms can be altered and new cooking and bathroom facilities installed. The size and age of the dwelling structure are likely to be especially important in affecting these costs.20

With respect to structure size, while marginal costs may be expected to rise slowly as the first one or two additional units are produced from a given structure, they will undoubtedly rise more rapidly as physical additions are made to the building in order to produce more dwelling units. However, this increase in the marginal costs of subdivision to produce an additional dwelling unit may be expected to be less, the larger the initial structure.

On the revenue side, it is expected that aggregate rents from the property will rise with the production of additional dwelling units, but as the average size of units becomes smaller (as it must) and living conditions in the property become more crowded, the rate of increase in aggregate rent will be reduced. In short, we would expect subdivision to be observed more often in the larger properties, because in such properties marginal costs rise at
a slower rate and marginal revenues fall at a slower rate with each new dwelling unit added than in the case of smaller properties. 21

A second variable which has been shown to be significantly (negatively) related to the costs of subdivision is the age of the property (McCann, 1975). However, conceptually, the role of age of structure as it relates to conversion is unclear. Among the reasons for the interpretative difficulty is that the historic pattern of development of the typical North American city has ensured that proximity to the central commercial core, age of housing and to a large extent lower quality housing environments are all highly correlated spatially. Thus it is not clear whether the expected higher propensity to subdivide older properties should be attributed to the (lower) costs with which they might be subdivided, or the fact that those who demand dwelling units in subdivided properties also demand the lower quality housing which often prevails in older structures (although it is also highly dependent upon the initial value category of housing being considered).

It is in this latter context that Muth, for example, argues "that the costs of converting good - to poor quality housing rise as the slum area expands from the center of the city" and that "newer dwellings and single family houses on larger lots would be more costly to convert to slum uses" (Muth, 1969:134). At the same time, the reasons for these expectations are not well developed.

In addition to the correlation between age of housing and accessibility to central city employment and between age and housing quality, it is also likely that the age of the dwelling structure reflects some general characteristics of older residential blocks and neighbourhoods. A further reason why a clear interpretation of the effects of age of housing on conversion is difficult is that it may not be age per se which is the germane feature, but the quality level and size at which such dwellings were originally constructed. Thus, in using age of structure in the model below we recognize its role as a composite variable and one which, although expected to be positively related to conversion, cannot be interpreted simply in cost terms alone.

In addition to size and age, some properties will be less costly to subdivide than others purely on the basis of their architectural and construction characteristics. Unfortunately, as far as this study is concerned, while a general measure of housing type was obtained from observation of the exterior...
of the sampled properties, these failed to add further information about the probability of subdivision once the variables of age and size were considered. Thus, such characteristics will not be considered further.\textsuperscript{22}

Thus far the spatial pattern of conversion has been related to changes in relative prices due to the extensions of the Bloor subway as these changes are expected to affect likely converters and non-converters. However, influential changes in relative prices are in the short run, they occur as relatively minor perturbations over a secular long run trend in the relative distribution of residential values. Therefore, differences among neighbourhoods are still expected to exercise a primary influence on which households bid and the uses to which they put the dwelling structure. Thus high income bidders continue for the most part to bid in higher valued neighbourhoods and low income bidders in low valued neighbourhoods. Our analysis of conversion, which is viewed as a short run change, has to be evaluated therefore against this historical pattern of neighbourhood change.

In order to assess the importance of this factor in altering the probability of conversion to higher density on the one hand and to low density on the other, we introduce a neighbourhood value measure. Since it is the neighbourhood value at the time of bidding which is likely to be most influential in governing the spatial distribution of bids, the median value of housing in the census tract in 1961, \text{VALUE}, is selected as the most appropriate measure. Our expectations are that, in addition to the preference of high income households for larger dwellings of higher quality, their preference for high quality neighbourhoods means that high income bidders will be more likely to offer a premium for such areas. Under this assumption alone, subdivision would be less likely to occur in such areas and the sign on the \text{VALUE} variable should be negative with respect to subdivision.

In the case of single unit dwellings, zoning places a legal restriction on subdivision in certain districts within the metropolitan area. In the case of multiple unit properties, the main zoning restriction is over the subdivision of properties into boarding or apartment houses, the latter implying three or more dwelling units (City of Toronto Zoning Bylaw, Ibid., p. 221).\textsuperscript{23} However, triplex dwellings are also permitted. On the assumption that most subdivisions of \text{multiunit} properties are for apartment houses, then the presence
of such a restriction would be expected to inhibit subdivision while all other zoning designations would act to encourage it.

Several other variables were also developed and examined for their relative effect on the probability of different types of conversion. Measures of the type of adjacent property were developed to indicate whether the sampled property was typical of those adjacent to it and whether neighbouring properties were commercial or vacant land. None of these measures had any systematic effect on the probability of conversion. Measures of traffic density were also investigated, but again without generating significant results.

The Variables

The variables introduced above are operationally defined as follows. In each case variables were entered in an additive manner after considerable exploration with alternative forms including their response to the presence of other variables. The expected signs of the relationships are given in parentheses:

- **AGE (+)** the decade when the property was built, where 2=post 1940 through 10, the decade of 1870-1879.
- **FLOOR (+)** the sum of the size of all rooms excluding the basement (unless this is defined as a room or rooms *per se*), verandahs and any temporary living space. Measured in square feet.
- **VALUE (-)** the current market value of single detached residential properties as estimated by homeowners in 1961. Expressed as a median for the census tract of the sampled property. Measured in $'00 (1961).
- **ZRI (-)** the zoning restriction pertaining to the property itself. Measured 1 if the zoning was R1 in the City of Toronto (and its Borough equivalent) and 0 otherwise. The base in the single-unit case was all other areas.
- **YRLIST (+)** the year of final market listing of the property by the vendor; measured as 58, 61, 62, 63, 64. These years correspond to the years of purchase by those whose conversion decisions we observe.
- **WALK1 (+)** walking distance to the nearest subway station. Measured 1 if between 0 and 1/6 of a mile.
- **WALK2 (+)** as in WALK1, measured 1 if property located between 1/6 and 1/3 of a mile from the station.
The results of the logit model are presented below, initially for single-unit dwellings (Section 6) and then for the multunit properties (Section 7).

SECTION 6 RESULTS FOR THE SINGLE UNIT CASE

According to the model developed in Section 5, the probability of subdivision of a single unit residential property into two or more units is expected to be negatively related to the costs of conversion, and to the presence in the market of high income bidders who would wish to retain the original single family residence. The probability of subdivision is expected to increase in areas where competition was not restricted by zoning and in locations where the relative bidding power of low income, higher density users is expected to have increased at a greater rate than low density, higher income households (such as in areas closer to the newly-constructed subway stations).

The results for the single unit case are presented in Table 1 in terms of four separate models. Together they offer considerable support for the above arguments. With respect to the cost terms, the results for the variable AGE and FLOOR are consistent with our preceding arguments; the lower priced, older single-unit properties are more likely to be selected by converters as those larger properties in which additional units can be produced more easily. Both of these results would help account for the higher number of converted properties south of the Bloor Subway line apparent in Figure 2.

Since restrictive zoning and high levels of neighbourhood quality tend to occur in the same residential areas, the two variables VALUE and ZRI were entered separately in the logit model. Zoning, which is regarded here as a cost inhibiting subdivision, clearly has the expected negative effect although the joint presence of competition from higher income low density bidders is also present.

Competition between different bidders was characterized in two ways: the traditional pattern of demand as represented in the distribution of
neighbourhood values prevailing at the time of purchase and through changes in the relative bids which led to alteration of those patterns. The first, represented by the variable VALUE, shows the relative importance of the prevailing market for higher values areas and that dwelling structures in these areas were far less likely to undergo subdivision than were single family units in lower valued areas.

However, in areas such as those close to the new subway stations, where the collective bidding power of lower income households was expected to increase, the probability of subdivision increased markedly. The result is a rise in the incidence of subdivision at each distance within half-mile bands from the new stations.

The question of expectations about future demands for different types of housing, and the way these demands may have influenced the propensity of converters and non-converters to bid for the same property, is investigated through the variable YRLIST, the year of purchase. The fact that YRLIST, while positive as expected is statistically insignificant, suggests that the effect of rising expectations regarding the returns to conversion following initial planning and excavation for the subway may not have changed greatly between 1958 and 1965. Intercorrelations (not shown) between YRLIST and the other variables in this model are very low, suggesting little systematic association between the year of the purchase and the other characteristics of the property.

SECTION 7 THE CONVERSION OF MULTIUNIT STRUCTURES

Figures 5 and 6 show the spatial distribution of subdivisions and mergers in multiunit properties. In contrast to the distribution of single unit properties, multiunit structures tend to be more spatially concentrated, especially in the older sections of the stock and particularly around the Bloor subway in the west end. As in the single unit case, however, the changes in the supply of dwelling units themselves are not clustered in any one location, but appear scattered throughout the map of sampled properties.

As indicated in the log likelihood equation (6), parameters may be obtained for the log odds of any alternative supply state being selected
Figure 5. The Location of Subdivided Multiunit Properties
The Toronto Inner Urban Area
Figure 6. The Location of Merged Multiunit Properties
The Toronto Inner Urban Area
with respect to any other as a function of a set of explanatory variables. Our interest in supply change means that it is the arguments associated with any departure from the stable state \( i = j \), which are of interest. Hence two sets of coefficients refer in turn to the log odds of a multiunit property being selected for further subdivision over no change, \( i < j / i = j \), and for merger over no change, \( i > j / i = j \).

In specifying the logit model for the multiunit case, two additional variables are of interest. Mergers make up just under half of the final states of properties which previously had three or more units, compared to only fourteen percent in the case of two unit properties. In order to control for effects of the magnitude of the presence of these additional dwelling units in a property on the probability of merger, the variable MTWO is entered; this variable is recorded 1 if three or more units already exist in the property and 0 otherwise. The second variable not included in the single unit model is a zoning code allowing further subdivision of properties, ZR4. This variable is coded 1 if the property is zoned \( R4 \), and 0 otherwise.

**Results of the Multiunit Case**

The results of applying the multinomial logit model to the subdivision and mergers of multiunit properties is given in Table 2. A number of characteristics regarding the nature of supply change in such properties are revealed. First, while variations in the subdivision of existing multiunit properties behaved according to the majority of expectations (as judged by the signs), such events appear to bear little consistent or statistically significant relationship to the recent addition of rapid transit (as judged by the low \( t \) statistics).

One of the reasons for the above result is that, in addition to adaptations to the existing stock during the study period, there was also considerable investment in providing new multiunit housing along the subway route (Bourne, 1968). While much of this was not cheap rental housing, this construction may still have weakened demand for small rental units in the area as a whole, reducing likely profit margins to would-be subdividers of multiunit properties. Nevertheless, the multiunit character of those properties located within walking distance of the stations was sustained, if not increased
TABLE 2

THE EFFECT OF THE BLOOR SUBWAY ON THE SUBDIVISION AND MERGER OF NEIGHBOURING MULTIUNIT PROPERTIES. A POLYCHOTOMOUS LOGIT MODEL. MAXIMUM LIKELIHOOD ESTIMATES
(t statistics in parentheses)

<table>
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<th>Variables</th>
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<th>Model 2</th>
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-2^log likelihood ratio 256.986 254.003
Subdivisions, mergers 58 74 58 74
Number of Cases 384 384
Log likelihood at zero -337.624 -337.624
Log likelihood at convergence -293.374 -294.866
p^2 .1311 .1266

*** Significant at .01  ** .05  * .10
during the period.

The null effect of the subway on the subdivision of multiunit properties is given some emphasis in the negative coefficients obtained for the merger alternative, although one would have to be prepared to accept higher than conventional chances of being wrong in interpreting these particular estimates. One might at least have expected the presence of the subway to noticeably detract from the merging of units and that that sign would be negative. However, it must be realized that housing standards were rising everywhere in the urban area during this period and the direct competition of larger rental units in new buildings may have led to some merging of three to two unit properties along the subway zone.

To the extent that properties with three or more units were located in the Bloor area originally, then the inclusion of the variable MTWO would reduce the variance specifically attributable to the subway and that of any other highly correlated with MTWO. Inspection of the relevant maps shows that while three or more unit properties were more likely to be present south of the new subway line in the older areas of the city, there was no clear disproportionate concentration around the subway line itself. Hence the spatial pattern of merger is unlikely to be attributable to the inclusion of MTWO in the model.

The results in Table 2 also indicate the nature of the redistribution of existing property among income groups in the city during this period. On the one hand, the results show that mergers tend to be made in the more recently constructed smaller properties in higher valued areas, and that mergers are less likely in larger properties, even those which are not in the older age brackets (for not all larger properties are necessarily old). Although it is possible to attribute the association of relatively small house size and merging to the tendency to transfer funds into expanding existing space rather than buying a larger dwelling unit, there may also be other reasons involved. First, competition from those seeking to supply housing to groups of low income households would not be so great in small properties thus allowing the single household bidder to successfully acquire that kind of property.
The second reason has to do with the fact that upon purchase of a multi-unit residential property, it may or may not be in the single household's interest to actually remove items such as the kitchen components from a room. The larger the property, the less is the need to make major adaptations to a second kitchen in order to enjoy single household living. Hence the failure to remove the second (or third) kitchen in a larger property upon the succession by a smaller number of households may be a measurement bias in the sample and may account for the significantly negative coefficient on the size variable FLOOR in the merger section of the multinomial equation.

It was argued above that the demand for larger sized dwelling units in properties previously supplying smaller units would also be accompanied by a rising demand for environmental quality. This expectation is confirmed by the results. Controlling for other variables in the equation, it is in areas with high values of owner-occupied single unit properties that multi-unit structures are most likely to be merged into single unit residences.

Finally, the fact that the existence of properties with three or more units (MTWO) is highly significant and that much of this form of supply change occurs in areas already zoned for rooming houses and the like, implies a growth in demand for housing space in areas formerly dominated by consumers of small unit housing.

SECTION 8 SUMMARY AND CONCLUSIONS

Property conversion has been defined in this study as a change in the number of dwelling units in a property so that an alternative set of consumers is supplied with housing. Increasing the size of a dwelling unit is seen as a response to the demand for "high income" households and any reduction in dwelling unit size was interpreted as meeting the demands of "low income" households. (Consideration of simultaneous quality changes was referred to in the text).

The Magnitude of Subdivision and Merger Activity

Subdivisions and mergers together yield an estimated net increase in the number of dwelling units in the pre-1947 housing stock of Toronto of nearly ten percent over the study period, an increase of about one percent
per year. Comparable estimates for other centres are difficult to obtain. McCann, for example, only gives the number of dwellings in converted property at a point in time and Bradbury's measures are for "a single composite variable": subdivisions, mergers, retirements and demolitions. Hence, until other studies are undertaken, this figure will have to remain tentative although some support comes from the roughly comparable evidence for census tracts estimated by the City of Toronto Planning Board (1974) and from conversion estimates developed from City Directories by Peddie (1978).

The flexibility and response of the stock as a whole is much more impressive. Of nearly 137,000 properties to which the sample refers, over 24 percent provided at least one additional dwelling unit over the decade. Of those properties which initially contained a single dwelling unit, nearly 35 percent provided one or more additional units during the study period, and even among those properties with two or more units over 14 percent were used to supply additional units. The net figure is smaller because nearly 20 percent of multiunit properties (which represent the larger proportion of the whole sample) showed a reduction in the number of dwelling units contained within properties. In the inner city stock under consideration, every property type showed a positive probability of being converted.

The fact remains however that most properties were not converted over the study period, a feature which suggests that the costs of obtaining housing of the desired type from newly constructed properties were by and large lower than the costs of purchase and conversion of existing older properties. In fact, cost constraints on conversion as measured by property characteristics dominate the findings and play a large role in determining the location of subdivision and merger activity.

Stock Characteristics and Conversion

The variable AGE, representing the period of construction of the residential property, played an important and independent role in accounting for the incidence of conversion activity, especially in the models applied to the subsample of single-unit properties. This result is consistent with those of other studies; as Bradbury notes, "old stock accounts for much of the conversion activity" (Bradbury, 1977:80). These results are also consistent
with those of McCann although his measures are slightly different.

Probably the most consistent constraint on subdivision and merger activity was the size of the property. Somewhat surprisingly, Bradbury does not specify size of property in her supply equations, which no doubt reflects her reliance on census data. McCann's results are quite consistent with those of the present study, at least in terms of the signs and relative strengths of the correlation measures (McCann, 1975:67).

The implication of the importance of the two measures age, and size of property for the locational pattern of supply change is that the distribution of conversion largely reflected the distribution of old and large properties. What is interesting, therefore, is the way that additional variables which did not simply measure stock characteristics, relate to the location of conversion activity, and we now turn to these.

**Micro Locational Effects**

Variables associated with micro locational effects did not register as particularly important in the models estimated here. The results emphasize that the relative importance of these variables may not be particularly useful in explaining conversion activity. Broader determinants of housing condition apparently outweigh the marginal effect of such small scale factors as proximity to nonresidential use, changes to non-residential use in neighbouring properties, and the location of arterial or low traffic carrying routes.

**Location Variables**

Far from being concentrated in a few areas, the three kinds of conversion activity taking place in single and multiunit properties, were widely distributed throughout the urban area. The aim of the locational analysis was not primarily to assemble a statistical model which would account for as much of the variance in each conversion measure as possible, but rather to test specific hypotheses which may be regarded as indicative of the process of conversion itself and of the forces which lie behind this form of change in housing supply.

Several points emerged. First, the application of the conversion models to the single-unit and multiunit subsamples shows that the same variables
have different effects in attracting converters to different types of property (a similar argument for such stratification may also be found in Bradbury, 1977). In general, subdivisions in the single-unit case are most likely to occur in older, larger properties located in areas which are not protected by zoning restrictions and are in low and middle value range residential neighbourhoods. While the first two variables undoubtedly reflect the costs of conversion in younger and smaller properties, the presence of subdivision activity in lower valued areas indicates that superior bidding by converters is still constrained by purchase prices and the fact that the estimated rents to be received by subdividers of the property are not sufficiently high to allow high locational premiums to be paid by buyers. In short, the production of smaller dwelling units are, by and large, associated with lower quality environments.

Mergers, the supply of larger dwelling units from existing properties, tended to be associated with the presence of other attributes. In particular, the observed importance of somewhat younger and smaller properties as inputs to larger dwelling units suggests that by and large collections of small space users are able to outbid even high income single family bidders for residential properties. The continued presence of zoning controls would reinforce this conclusion.

The Effect of Changes in Demand for Housing on Conversion

The construction of the Bloor subway line was used as a measure of a location specific change in the demand for housing. Not only does the Bloor subway extend through major sections of low income housing but the increase in the speed and efficiency of transport used by low income commuters raised the location rent payable by groups of such bidders. The result was a significantly higher probability of subdivision of single-unit properties within walking distance of the new subway stations. However, while the price of property rose along the line, partly because of a capitalization of the increased differential rent resulting from the new transit facility and partly because of a reduction in supply of properties through demolition, this was not sufficient to generate additional housing from multiunit properties neighbouring the line.
A number of studies point to the importance of conversion as part of the process whereby dwelling structures 'filter down' to lower income groups. See for example Birch (1971) and Andrews (1971). Also see note 8.

The argument has been made in the context of price differentiation in black and white housing submarkets, notably by Berry (1976).

The detailed work by Brown (1975) and Peddie (1978) are examples of neighbourhood based studies of property conversion.

The cost of acquiring a property is an investment cost and since it only involves the transfer of wealth and it does not represent a use of physical resources, it is not a 'cost' in the economist's sense. (Smith, W. 1970:19).

This assertion is supported by a reexamination of evidence supplied by Brown, P.W. (1975, pp.125-130) as reported in detail in Morrison, P.S. (1978a, pp. 306-311). In general, conversions are more likely to be made by new owners whether these are owner occupiers or absentee owners, a result which holds for purchases throughout the 1960s (at least for the Junction area of the City of Toronto). Smith, P.J. and McCann, L.D. provide corroborating evidence from their examination of the Edmonton experience (1975, pp. 30-37). They note from interviews that 40 percent of all converted dwellings had been converted within a year of change of ownership (p.35).

We reach this particular conclusion in two ways. First, empirical evidence on changes in housing quality suggest that larger expenditures on rehabilitation are more likely to be made by new house buyers; Morrison, P.S. (1978b). Secondly, since new buyers are in the market, their awareness of market trends will likely be greater than incumbent or longer term owners who subdivide or merge a dwelling unit in response to non market forces such as changes in family size. For an account of the latter see Lipstein, (1956).

For an account of the dynamic relationship among those housing sales see Peddie (1978) and Brown (1975).

Both terms, although popular, are misleading at least for analytic purposes. For a discussion of the problem of interpreting filtering, see Grigsby (1971, Chapter III). Conversion and filtering should not be considered transferable concepts. Only if downward shifts in price per unit of housing space can be identified as accompanying subdivision, can this form of conversion be associated with filtering. While there is no comparable critical evaluation of the term gentrification, the summary by Gale (1979) is useful.
For example see Bradbury (1977). Ingram and Oron noted that production based models (of which Bradbury's is derivative) are limited to the adjustment of structure quality and ignore possible changes in the demand (Ingram and Oron, 1977:289).

We draw on Wrigley's (1975) exposition in the specification of our model.

The definition is very similar to that used by Lipstein (1956).

Conventional statistical sources can grossly underestimate the level of conversion activity. Nevertheless, by 1974 dwelling units planned by conversion amounted to over 4 percent of all new construction planned in the city of Toronto. (Statistics Canada, Cat. 64-001, 1975.)

These figures were computed by the author. The sampling scheme and the area covered is described in detail in Morrison (1978a). The conclusion of net additions of dwelling units of 10 percent during the 1960s was very close to that estimated from an alternative data set by Peddie (1978).

For detail, see Morrison (1978, Chapter 4).

For further details, see Morrison (1978, Chapter 4).

Evidence on holding periods by location was provided by Brown, 1977.

Dewees observed that "several incomes classes are likely to share an area, and transport improvements are likely to affect different classes differently, causing some reallocations within the area, changing imputed site rents". In a simulation study, under reasonable assumptions about parameter values drawn from the Toronto experience, Dewees notes that "at the lowest income level the ... subway...involves the least cost...in terms of travel", Dewees, D.N. (1973, p.42). And, "moving from low to higher income levels increases the cost of travel by all modes, but the public transportation costs rise much more rapidly than those of the automobile" (Ibid.) Hence "higher income travellers tended...to use the automobile in place of public transportation so that total transportation cost savings for public modes fell off at high income levels." (Ibid., p.63). Related evidence is cited by Ingram (1980); "auto-ownership levels increase strongly with income and are affected relatively little by age..." (Ingram, 1980: p. 329).

The effect of a price rise in surrounding properties as we have developed the argument is consistent with that put forward from a slightly different point of view by Muth:

"If housing service price differentials are not offset by cost differentials, existing real properties will be valued more highly and, consequently, firm equilibrium requires that they be more intensively used in the higher
housing service price area. Fixed structures, street layout, and the like, may limit substitution possibilities in the short run and, hence, the incremental output resulting from the housing price differential. But through expenditures for interior conversions to more units with more cooking and toilet facilities, the output of housing per unit land can increase even in the short run. In addition, more people may inhabit a given amount of space in the higher-priced area because the effect of higher prices is to reduce the per household or per capita consumption of housing services." (Muth 1969: p. 135) (my emphasis)

19 See Morrison (1978b) for details.

20 Elsewhere (Morrison, 1978a., pp. 263-266), it is shown that there is no statistically significant association between stability, subdivision and merger of dwelling units in a property and change in quality as measured in categories of maintenance, minor and major repair and rehabilitation.

21 The conditional effect of quality upgrading was examined for dwelling units undergoing subdivision and merger of dwelling units in a property and change in quality as measured in categories of maintenance, minor and major repair and rehabilitation.

22 Size and age were also considered as interactive terms but yielded little additional insight.

References


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