CONSUMER'S SURPLUS AND BEHAVIORISM IN A MODEL OF THE DECISION-TO-MOVE

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Introduction

As has been noted by several researchers working in this area, there has been little effort extended toward the development of microeconomic theory based models of intraurban mobility (Quigley and Weinberg, [17]). Greater emphasis instead has been placed on reformulation and extension of the behavioral concepts of residential stress, place utility, and satisficing in the context of the decision to move. Given the long-standing use of these concepts in mobility research and the extensive development of neoclassical residential equilibrium theory, the question is oft asked whether these two theoretical structures may be combined to enhance our understanding of mobility decisionmaking processes. This would seem to indicate the need for an economic model of the decision to move. The purpose of this note is to review and elaborate on the consumer's surplus approach of Quigley and Weinberg [17] as a residential disequilibrium model of the decision to move.

Of the consumer behavior models portraying the decision-to-move process developed to date only the Quigley-Weinberg model (hereafter Q-W) is explicitly developed under consumption side microeconomic theory. Brummell [2], however, has raised some concern over whether the consumer's surplus approach is capable of incorporating such concepts as residential stress and place utility in its structure. Other recent economic behavioral models of the decision-to-move process, such as those by Brummell [2] and Goodman [8], treat these concepts explicitly in their structure. One of the major problems encountered with this pure behavioral approach to modeling the decision-to-move is the inordinate data requirements for test of the theory. See, for example, Brummell [3]. If indeed a microeconomic model of the decision-to-move can adequately capture elements of the behavioral theory it may be possible to test this theory with much more readily available economic data.

The first concern of this paper is to show that some form of both place utility and residential stress are implicit in the Q-W model. Second, the model is examined, via comparative statics, for testable hypothesis content and consistency with existing knowledge on the decision-to-move process. By framing the model in a slightly more general structure a link is then established with neoclassical residential equilibrium theory. This latter structure may be particularly useful for examining the effects of externalities or service level decay on the decision to move.

Consumer Surplus and the Q-W Model

By way of review of the consumer surplus concept and introduction to the Q-W model this discussion utilizes the example of household residential services consumption. Utility is defined in the ordinalist sense; the consumer can only rank consumption bundles not attach any specific value of satisfaction to any of the bundles in a consumption set, as in the cardinalist sense. The appropriate consumer surplus referred to herein is the Hicksian measure, which measures the

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net gain or loss in welfare from consumtion of a goods bundle as prices change, holding utility constant. In adopting the ordinalist framework the problem of interpreting marginal utility of income, as in the Marshallian measure of consumer surplus, is avoided. This also allows a later link to neoclassical residential equilibrium theory.

Consider the following structure. Households consume two goods; housing services, H, and a composite good, x. The appropriate decision framework is maximization of utility subject to a budget constraint.

$$(1) \quad \text{Max.}_{(i)}U = U(H,x)$$
$$\text{s.t. } Y - p_h H - p_x x = O;$$

where Y is household income, p_h is the unit price of housing services, and p_x is the unit price of the composite good. Via the ordinalist framework the behavioral postulates of this decision structure are well defined. These include complete ordering, reflexivity, transitivity, and closure of preferences. Without loss of generality assume a finite series, (i=1, . . . , n), indexing all housing services bundles in the city. The residential consumption decision process may then be stated as:

$$(2) \quad \text{Max.}_{(i)} U = U(H_i, x)$$
$$\text{s.t. } Y - p_h H_i - p_x x = O.$$

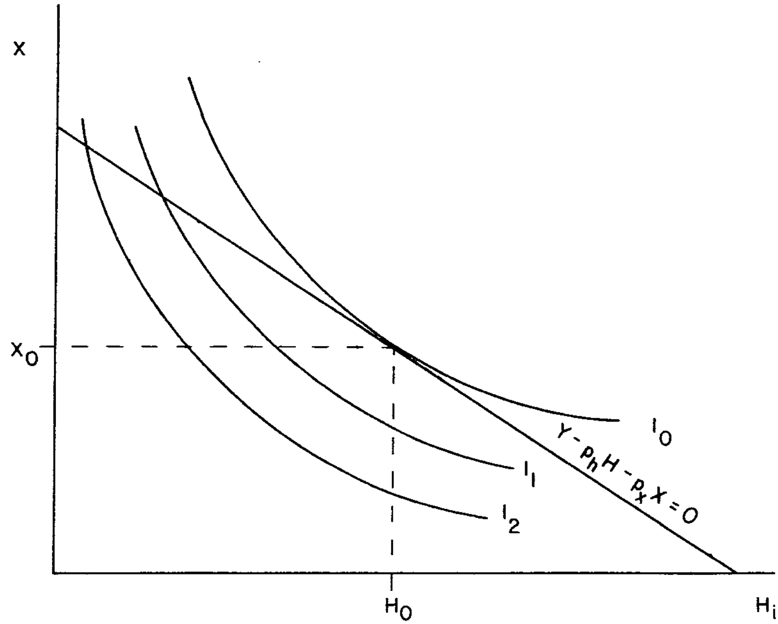
Here utility is maximized over the set i, (i=1, . . . , n), of all housing services bundles. Where n is large, divisibility in H can be readily assumed. The choice of a unique i, i.e., a unique housing services bundle, is implicit in this framework.

In (1) and (2) the convention of expressing the housing good as a bundle of services, H, was adopted. Without loss of generality H_i can be decomposed into a vector of housing specific services, $H_i = (h_i^1, h_i^2, \ldots, h_i^m)$. The elements of this vector may represent such individual services as lot size, number of bedrooms, floor area, and location; each of which are specific to the housing bundle indexed i. Given the finite series of housing bundles in the city and the decomposed nature of H_i, a rough form of place utility is implicitly incorporated into the decision structure (2). This is evident in the contribution of location services to the total services consumption bundle and in the relative contribution of other unique housing services. Holding consumption of the composite good fixed, in (2), translates utility directly into a concept of place utility similar to that defined by Wolpert [21] (see also Pryor, [16]).

Given that the household has selected a residence the question we wish to ask is whether there is any means of measuring the household's welfare gain or loss at this residence with changes in the parameters of its decision process. The measure proposed by Q-W is the welfare economics concept of consumer surplus. A household's welfare gain or loss is economically consistent with the behavioral theory concept of residential stress. Because the household is constrained to a fixed consumption of housing it is unable to perfectly substitute goods in its utility bundle. This inability can be measured, economically, as a welfare gain or loss and its substance closely resembles Wolpert's [22] definition of residential stress.

Let us reconsider the price-taking household depicted in (2). The selection of a unique housing services bundle, H_O, places the household on the highest indifference curve, I_O, tangent to its budget constraint (Figure 1). As depicted here,

Figure 1: Household Utilty Maximization

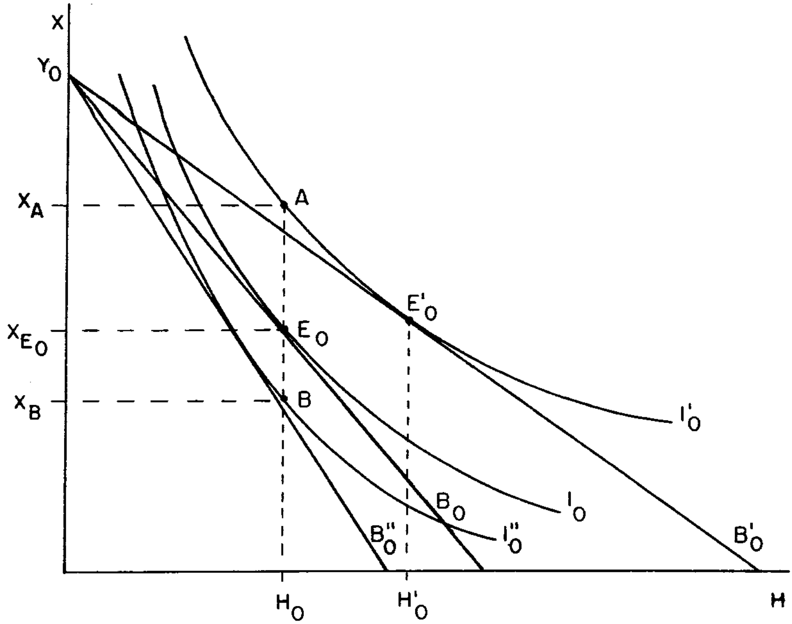


the indifference curves for all other housing services bundles will lie below and to the left of the level curve I_0. This initial household equilibrium, i.e., consumption level H_0, will serve as the reference for measurement of welfare changes.

In contrast to the price-taking household adopted here, residential equilibrium theory posits household determination of a bid-rent price for a unit of housing services. This bid-rent price, p_h', may or may not be equal to the per unit housing services price, p_h, faced by the price-taking household. Thus, as Hanushek and Quigley [9] note, the price-taking household may initially be at disequilibrium with respect to its own bid-price for this level of housing services. The measure of this welfare gain or loss, via price taking as opposed to price bidding, is the Hicksian concept of equivalent surplus, holding consumption constant at H_0 (Currie *et al.*, [4]). Without loss of generality, we assign p_x the numeraire and define x as unallocated income after purchase of housing services; i.e., x is the unallocated composite good budget. The initial measure of household disequilbrium is the amount of money the household would be willing to take or pay to keep it at consumpton level H_0 when its bid-price for the level of housing services H_0 is p_0'; the equivalent surplus in income between price levels p_0 and p_0'. This can be seen more readily diagramatically.

For the sake of argument, assume the household's own bid-price for the housing services bundle H_0, p_0', is less than the market price, p_0, faced by the household. Budget line B_0, in Figure 2, represents the household's budget contraints under per unit housing services market price p_0; line B_0' represents the household's budget constraint under own bid-price, p_0'. Given budget constraint B_0' the price-bidding household will achieve utility level I_0', while consuming H_0' housing services. Note that the relative location of the housing bundle is implicit in both the bid-price for the housing service bundle, p_0', and in the final consumption of housing services. Indeed residential equilibrium theory tells us that

Figure 2: Consumer's Surplus Measure of Welfare Loss



housing consumption will be further displaced from the city center at a lower bid-price for a unit of housing services. Clearly, then, the household is at a lower utility level, I_O, when constrained to price-taking behavior. The utility level I_O' is what it would like to achieve; utility level I_O is what it is capable of achieving under (2).[1]

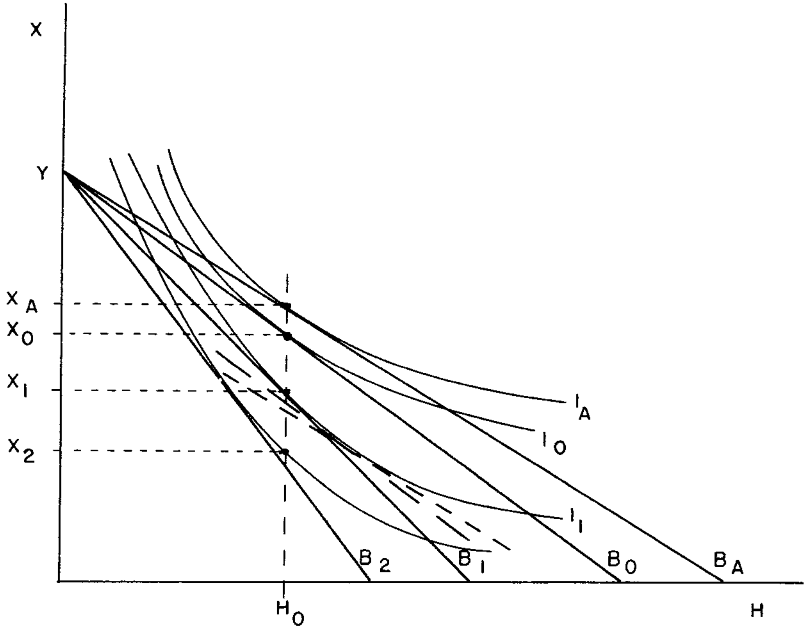
The system depicted in Figure 2 indicates that the price-taking household suffers a welfare loss from its position as a price bidder (given $p_h' < p_h$). Constraining the household to a fixed consumption of H_O units of housing services would place it at the consumption mix **A** on I_O', in Figure 2. The household's welfare loss, via price-taking as opposed to price-bidding behavior, is the difference in unallocated income $x_A - x_{EO}$; the corresponding measure of equivalent surplus. Alternatively, for $p_h' > p_h$, where B_O' represents the budget constraint, the household's welfare gain is the difference in unallocated income $x_{EO} - x_B$.

Development of Testable Hypotheses

The Quigley-Weinberg model posits that households will move if their welfare loss, suffered at the present housing unit, with some change in a parameter of their decision framework exceeds the cost of moving [9]. Among such parameters we include the household's income, the unit price of housing services, and the characteristics of the housing consumption bundle. More formally, Weinberg [18] suggests the following disequilibrating forces possibly leading to a decision to move:

[1] Presumably, utility level I_0' is identified as the household's *aspiration utility*; here well defined by the utility function and the household's budget constraint (see Brummell, [2]).

Figure 3: Household Welfare Loss after a Price Change



i) forces shifting position or slope of the budget constraint; eg. changes in income or unit price of housing services,

ii) forces shifting the position or slope of household indifference curves; eg. a change in life-cycle which may produce a change in the parameters weighting components of the consumption bundle, and

iii) forces changing the utility of a given consumption bundle, exogenous to the household; eg. a change in the characteristics of the housing bundle.

An examination of the behavioral implications of parameter changes of types (i) and (ii) is undertaken here, via a comparative statics exercise. Examination of the third type of parameter change involves respecification as either a price or income effect and is discussed briefly in the following section.

Analysis of Price Effects. Again, consider the prict-taking household whose decision process is described by (2). Let us first examine the effect of a change in the unit price of housing services on this household. Without loss of generality, we can assume that this household's bid-price for housing services remains constant. Figure 3 represents, graphically, the type of price-consumption system we wish to consider. The household's price-bidding budget curve and utility level are given by lines B_A and I_A, respectively. Utility level I_A serves as reference for our measure of disequilibrium. An initial equilibrium for the price-taking household is given by the tangency of level curve I_0 with budget line B_0. As the unit price of housing services increases the budget line rotates, at the composite good axis intersection point — y, toward the origin. Thus in this system, the unit price for housing services paid by the price-taking household is assumed to be greater than is bid-price. Budget lines B_1 and B_2 represent the household's consumption constraint at increased unit prices for housing services.

As the unit price of housing services increased from P_{h0} to P_{h1}, shifting the relevant budget constraint from B_0 to B_1, household disequilibrium increases. Recall, the price-taking household is constrained to H_0 consumption units of housing services at its present location. Initially the household is at disequilibrium, where the relevant compensating income measure of consumer surplus is $x_A - x_0$. With an increase in the unit price of housing services, from p_{h0} to p_{h1}, total household disequilibrium is now the compensating income level $x_A - x_1$, whereas the increment change in disequilibrium is the compensating income level $x_0 - x_1$. Although total household disequilibrium may be of some practical concern, empirical evidence accumulated by Hanushek and Quigley [9] suggests that it is the incremental change in disequilibrium which is more influential on the household's decision to move.

The measure of consumer disequilibrium via the consumer's surplus concept is usually approximated through consumer demand functions for the good or goods undergoing a price change. Here the relevant standard for approximation of consumer disequilibrium is the Hicksian compensated demand function, with utility held constant. The precise measure, in unallocated income terms, of the welfare loss following a price increase (such as from p_{h0} to p_{h1}) is the area to the left of the compensated demand curve, determined at the subsequent utility level, between the two price lines.[2] In practice there is little difficulty estimating this measure from the ordinary demand function, when it is empirically known (Willig, [20]).

At this point we again appear to be saddled with formidable methodological problems in testing our theory. In order to measure residential stress in the framework of (2) we either need knowledge of household utility function forms or must be able to estimate compensated demand functions for housing. Hanushek and Quigley [9] provide a rough test of this theory by approximating ordinary demand functions and deriving the Marshallian measure of consumer surplus. Moss [12], however, has suggested that expenditure function analysis provides an alternative means of assessing welfare gain or loss; this, furthermore, without the complication of making explicit utility reference. Theoretically, expenditure function analysis represents the dual to the consumer utility maximization problem, (2). See, for example, Diamond and McFadden [6] and Baumol [1]. The remainder of our analysis will be developed in this mode.

The dual to the consumer utility maximization problem (2) is the following expenditure minimization problem.

$$(3) \quad \text{Min.}_i \; p_h H_i + p_x x \qquad \text{s.t. } U(H_i, x)\; U^*$$

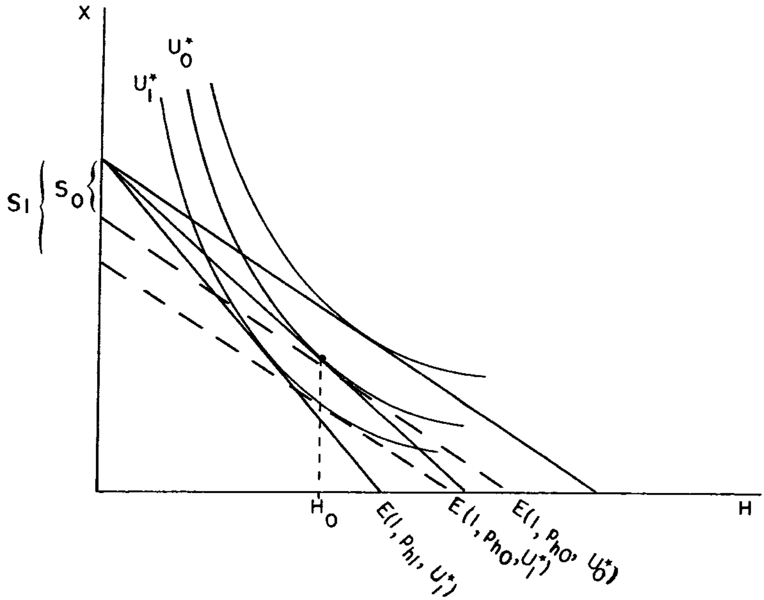
The expenditure function $E(p_x, p_h, U^*)$ represents the minimum income necessary to solve this problem. Here, and in the following, we take the price of the composite good as numeraire. Thus $E(1, p_h, U^*) = x + p_h H_0$; x is unallocated income and p_h is the relative unit price of housing services. Following the previous discussion, the expenditure function is evaluated at the subsequent utility level for the prior and subsequent price levels. For a price increase, from p_{h0}

[2] This incremental loss is evaluated as the solution to $\int_{p_{h1}}^{p_{h0}} H(P, I_1)\, \partial p_h$

whereas total household disequilibrium is the solution to $\int_{p_{h1}}^{p_h} H(P, I_1)\, \partial p_h$

at the new unit housing services price level p_{h1}.

Figure 4: Measuring Welfare via the Expenditure Function



to p_{h1}, the difference in expenditure levels $E(1, p_{h1}, U_1^*) - E(1, p_{h0}, U_1^*)$ is consistent with the welfare measure of consumer surplus (Moss, [12]). This is illustrated in Figure 4 by the amount S_1, found by the gap between where the expenditure functions, both tanget to U_1^*, cut the x axis. The household moves if

$$(4) \quad (E(1, p_{h1}, U_1^*) - E(1, p_{h0}, U_1^*)) - C^* > 0,$$

i.e., if the welfare loss exceeds the cost of moving, C^*[3].

We reconsider the simple case of a unit housing services price change from p_{h0} to p_{h1}, $p_{h1} > p_{h0}$. The original level of household stress, S_0, is defined by

$$(5) \quad S_0 = E(1, p_{h0}, U_0^*) - E(1, p_b, U_0^*);$$

where p_b is the household's bid-price for unit housing services at its present consumption level, H_0. Further, we assume $p_b < p_{h0}$. Following the unit housing services price change, household stress, S_1, is defined by

$$(6) \quad S_1 = E(1, p_{h1}, U_1^*) - E(1, p_b, U_1^*).$$

Holding constant income and the level of housing services consumed, in the limit, the change in household stress produced by the price change $\Delta S = S_1 - S_0$ (see Figure 4). We note the following definitions.

[3] The cost of moving variable, C^*, is a flow variable. Conceptually, it may represent the discounted cost of a move over the life of the household.

$$(7a)\quad E(1, p_{h0}, U_0^*) = x + p_0H_0 = Y$$
$$(7b)\quad E(1, p_b, U_0^*) = x_b + p_bH_0$$
$$(7c)\quad E(1, p_{h1}, U_1^*) = x' + p_{h1}H_0 = Y$$
$$(7d)\quad E(1, p_b, U_1^*) = x_b' + p_bH_0$$

Expanding ΔS by the definitions of S_1 and S_0 and by the above four definitions and simplifying.

$$\Delta S = \Delta x - \Delta x_b + H_0\Delta p_h$$
$$(8)\quad \Delta S/\Delta p_h = \Delta x/\Delta p_h - \Delta x_b/\Delta p_h + H_0$$

However, from the equality of (7a) and (7c), in income, $\Delta x = - \Delta ph_0$. Therefore (8) simplifies to:

$$(9)\quad \Delta S/\Delta p_h = -\Delta x_b/\Delta p_h$$
$$(10)\quad \lim_{\Delta p_h \longrightarrow 0} \Delta S/\Delta p_h = \partial S/\partial p_h = - \partial x_b/\partial p_h$$

In order to evaluate the sign of $\partial S/\partial p_h$ we need to reexamine the structure of the problem. Define x_b implicitly in own price, p_b, and U^*, $x_b = x_b^*(1, p_b, U^*)$; where U^* is defined as the indirect utility function derived from (2), $U^* = U^{**}(1, p_h, Y)$. Differentiating the composite function with respect to p_h

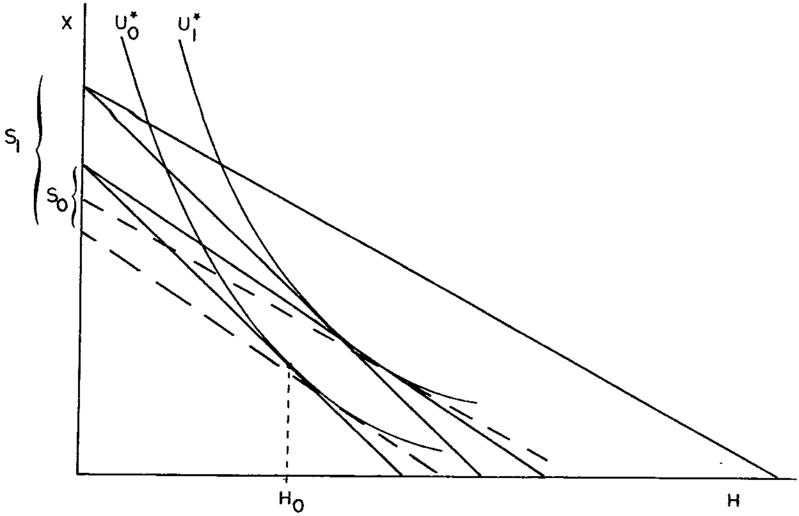
$$(11)\quad \partial x_b/\partial p_h = \partial x_b^*/\partial U^{**} \cdot \partial U^{**}/\partial p_h;$$

where $\partial x_b^*/\partial U^{**} > 0$ and $\partial U^{**}/\partial p_h < 0$. Hence, $\partial S/\partial p_h > 0$, i.e., residential stress, measured as a welfare loss, increases with an increase in the unit housing services price. This result is consistent with our expectations and the results of other behavioral decision-to-move models (Brummell, [2]), when income is held constant.

Analysis of Income Effects. Although income is not an explicit parameter of our decision framework, (3), the analysis of income change effects is not withholding in this structure. One of the general results derived for the price-bidding household in the Muth/Mills urban model framework is the inverse relationship between income and household bid-rents for a specific location (Muth, [15]; Mills, [11]). Wheaton [19] shows that as household income increases the household's bid-rent for that location decreases, holding location constant. This result serves as the basis for our examination of income change effects on household residential stress.

Consider the following system. The household is initially at equilibrium, consuming H_0 units of housing services at price p_h per unit and income Y_0. In a price bidding context this household would bid a unit housing services price p_{b0} at its present income for a particular housing services bundle. Assume $p_{b0}<p_h$, thus the price-taking household is initially at disequilibrium with respect to its price-bidding behavior. Following an increase in household income, from Y_0 to Y_1, the household shifts to a new utility level and offers a lower bid-price for its present housing unit, $p_{b1}<p_{b0}$. Such a scheme is depicted in Figure 5, where S_0 is the initial household welfare loss from price-taking as opposed to price-bidding and S_1 is its welfare loss in this situation following an income increase. The change in household residential stress following the change in income, $\Delta S = S_1 - S_0$.

Figure 5: Household Welfare Loss After an Income Change



Define the following conditions.

$$(12)\quad \Delta S = S_1 - S_0 = E(1, p_h, U_1^*) - E(1, p_{b1}, U_1^*) - E(1, p_h, U_0^*) - E(1, p_{bo}, U_0^*) - \Delta Y$$

$$(13a)\quad E(1, p_h, U_1^*) = x_1 + p_h H_0 = Y_1$$

$$(13b)\quad E(1, p_{bl}, U_1^*) = x_{bl} + x_{bl} + p_{bl} H_0$$

$$(13c)\quad E(1, p_h, U_0^*) = x_0 + p_h H_0 = Y_0$$

$$(13d)\quad E(1, p_{bo}, U_0^*) = x_{bo} + p_{bo} H_0$$

In this system the unit price of housing services faced by the household, p_h, and the quantity of housing services consumed, H_0, are held constant, i.e., actual rent paid is held constant. The term ($-\Delta Y$), in (12), accounts for the parallel shift in the indifference surfaces with the change in income (Dixit and Weller, [17]).

Expanding (12) by conditions (13) and simplifying yields

$$\Delta S = \Delta Y - \Delta x_b - H_0 \Delta p_b - \Delta Y$$

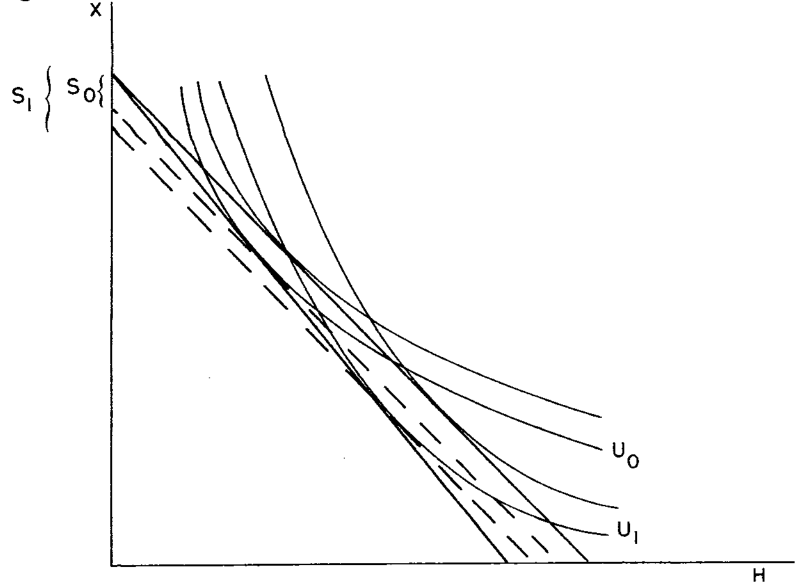
$$(14)\quad \Delta S/\Delta Y = -\Delta x_b/\Delta Y - H_0 \Delta p_b/\Delta Y$$

The quantity $H_0 \Delta p_b$ describes the change in bid-rent for the level of housing services H_0. Denoting this change as ΔR_b, (14) in the limit reduces to:

$$(15)\quad \lim_{\Delta Y \to 0} \Delta S/\Delta Y = \partial S/\partial Y = -\partial x_b/\partial Y - \partial R_b/\partial Y$$

The sign of (15) is ambiguous. Here, $\partial x_b/\partial Y > 0$, i.e., the amount spent on the composite good increases with income, whereas by definition $\partial R_b/\partial Y < 0$. It follows that $\partial S/\partial Y \lesseqgtr 0$ as $-\partial x_b/\partial Y \lesseqgtr \partial R_b/\partial Y$. That is, if a household's bid-rent decreases more rapidly than its composite good purchase increases, with an increase in income, residential stress increases. This condition is more readily seen in terms of elasticities.

Figure 6: Welfare Effects of a Change in the Utility Function



$$(16)\ \partial S/\partial Y \lesseqgtr 0 \text{ as } -\rho_{x_b}\epsilon_{x_bY} \lesseqgtr \rho_{R_b}\epsilon_{R_bY}.$$

Where ρ_{xb} is the fraction of income spent on the composite good under price-bidding behavior and ϵ_{xbY} is the income elasticity of expenditure on the composite good. Muth [13] estimates $\rho_R = 0.251$, from market data. By the condition $\rho_x + \rho_R = 1$, this implies $\rho_x = 0.749$ and

$$(17)\quad \partial S/\partial Y \lesseqgtr 0 \text{ as } -\epsilon_{x_bY} \lesseqgtr 0.33\epsilon_{R_bY}.$$

Thus we expect households with lower income elasticities of bid-rents to be less prone to moving. That it, households whose bid-rent curve is relatively flat in the neighborhood of their present housing consumption bundle are less prone to move. In a multiple income class city we might then expect higher mobility rates by lower income households.

Analysis of Utility Function Shifts. Underlying our analysis thus far has been the assumption of a well-defined fixed consumer utility function. Parameter changes within the utility function, producing a shift in position or slope of the indifference surface, cannot be directly evaluated for effects on household residential stress with the expenditure function mode of analysis. The point of this discussion, however, is to show that such parameter changes in the household's utility function are equivalent to household income change, holding the utility function fixed.

Consider the price-taking household initially at equilibrium on its budget constraint, $Y - x - p_hH_0 = O$. A change in this household's utility function has the effect of shifting the point of tangency of its indifference surface to the budget constraint. If the price-taking household was initially at equilibrium with its price-bidding budget constraint, suffering no initial residential stress, then it follows that it will also be at equilibrium with its price-bidding budget constraint following the change in its utility function (see Figure 6). Thus the household experiences no change in welfare gain or loss following the change in its utility function. Clearly this case is not very interesting, or realistic. In the remainder of this analysis we examine the case where $p_h > p_b$, the unit price of housing services is greater than the bid-price, and the household suffers some initial welfare loss. The discussion proceeds diagramatically from Figure 6.

Recall that the Hicksian measure of consumer surplus employed in this analysis measures welfare change from the subsequent utility level following a parameter change. Therefore welfare gain, or loss, is measured with respect to the household's utility level following any change in the utility function. In Figure 6 this welfare loss is represented by S_1, measured with respect to the prior indifference curve — U_1, (whereas the previous level of welfare loss is represented by S_0, measured with respect to the prior indifference curve — U_0.) The change in welfare loss, S_1 - S_0, following a change in the household's utility functon is a result of a change in the indifference curve-budget constraint tangency point. Technically, since we are dealing with ordinal utility, direct comparison of S_0 with S_1 is not possible. Since both may be measured, however, the money equivalent of these welfare losses may be compared. The market budget constraint remains fixed, thus this change in welfare loss may be conceptually interpreted as an income effect.

It follows, from our diagram, that residential stress increases as the indifference surface tanget to the market budget constraint shifts downward and to the right. An upward and leftward shift in the relevant subsequent indifference surface implies the converse. That is, as housing consumption becomes more important in the household's utility function, residential stress increases at fixed income and prices. The deviation of unit housing services price faced by the price-taking household from its bid-price has greater impact on residential stress as housing consumption become more important in the household's utility function. Such changes in the importance of housing may be due to changes in the size of the household or life-cycle changes. Since an upward shift of the household's indifference curve along the budget constraint implies reduced household welfare loss any force producing this result may be welcomed by the household. The simple case involving a reduction in household size, which decreases demand for housing services, suggests that overconsumption of housing services may be consistent with the household's reduction in welfare loss and its decision structure.

The analysis of consumer surplus as a measure of residential stress in the decision-to-move process has stressed only price or income parameter effects thus far. By developing the comparative statics of these effects from the household expenditure function, emphasis has been placed on the use of these functions for measuring welfare effects. Secondary emphasis in this analysis was placed on establishing a link between behavioral theory of the decision-to-move and residential equilibrium theory. In the following section we briefly relate the effects of residential service level decay and externalities to residential stress, as a welfare loss, with the aim of exposing the value of the consumer surplus approach to other urban inquiries.

Exogenous Disequilibrium and Residential Stress

In the urban economic literature two of the most heavily covered disequilibrium topics are housing unit depreciation and externalities, or neighborhood effects. Exogenous to the household, the effects of these forces in the market can be measured by the resultant changes in consumer's bid-rents or land prices. See, for example, Muth [14] and DeSalvo [5]. Given that a particular housing unit, or location, is inhabited during some change in one of these exogenous forces some of the effect must be internalized by the household as well. In particular, we expect such exogenous forces to produce some change in household welfare. These changes in welfare may be effected through a change in household utility or through some change in the parameters of its decision process. Here we examine two cases, first, welfare changes due to housing service level decay, and second, welfare changes precipitated by an unpriced residential disamenity.

Residential housing services decay, over time, is one example of an exogenous disequilibrating force internalized by the household through parameter changes in its decision process. For the household facing a fixed dwelling rent, $R = p_h H$, decay in the level of housing services produced by the unit, H, may be directly translated into an increase in the unit housing services price paid, p_h, over time. Holding constant household bid-prices and income, this situation simplifies to a unit housing services price change effect on household welfare. Alternatively, this welfare loss may be measured as the area under the compensated demand curve between the prior and subsequent housing services levels consumed. Interpretation as the former may facilitate measurement of this effect. In which case we expect the former price parameter change result to hold, i.e., household welfare loss increases due to unit service level decay.

The more interesting exogenous disequilibrating force to consider is some form of residential disamenity or neighborhood externality. Typically such phenomena are internalized by the household through its utility function and are unpriced in the market (see Kanemoto, [10]. Thus, for example, the utility function in (2) may be redefined as $U = U(x, H, d)$; where d is the local level of disamenity and $\partial U/\partial d < 0$. The disamenity term, d, may represent such phenomena as proximity to some noxious facility, level of air pollution, or local density of another ethnic or racial group. Since d is unpriced, yet is consumed at some non-negative amount, its presence as a non-zero level effects a shift in the household's indifference surface in commodity space.

Referring again to Figure 6, let U_0 represent the household's equilibrium indifference level, in commodity space, with zero level of $U_0 = U(x_0, H_0, d_0)$; $d_0 = 0$. The introduction of a positive amount of the disamenity d present. In this case U_0 is well defined and produces lower household utility and a mapping of this indifference surface into commodity space as a second family of indifference curves. Conceptually, the commodity plane cuts the three-dimensional indifference surface at a different point along the d axis, resulting in a second family of indifference curves in commodity space (U_1 in Figure 6). Where the commodity d is unprice a change in its level present is synonymous with the income effect on household welfare developed above.

Discussion

Often times behavioral scientists discount the viability of economic behavioral modeling as a means of describing individual decisionmaking processes. Such has been the case with the development of behavioral theory of the decision-to-move, although the decision process is treated largely as an economic one. This analyis has taken the liberty of redefining some of the concepts employed in behavioral theory in a more general economic form. Indeed, we have seen that some form of place utility, aspiration utility, and residential stress are incorporated in a utility maximization framework. Specifically, residential stress is defined as household disequilibrium and measured as a welfare gain or loss via consumer's surplus. By developing the comparative statics of the Q-W model, with reference to price-taking as opposed to price-bidding consumer behavior, the general consistency of this model with other behavioral models was also shown. Our results, however, are much more specific and suggest a series of testable hypotheses.

It is difficult, and perhaps dangerous, to argue the validity of one philosophical approach over another. In this regard this paper raises a number of interesting and impelling issues. The suggestion that household residential stress may be measured by the analysis of household expenditure presupposes that residential stress is economic disequilibrium. To what extent does this measure of stress coincide with non-economic household stress? Unit housing services price and household income changes, notwithstanding, the incidence of change in a residential environment has psychological as well as possible economic effects on the household. Furthermore, is price-bidding household behavior a good standard to measure welfare changes against? This analysis and empirical work by Hanushek and Quigley [9] suggest that both underconsumption and over-consumption of housing services precipitate a decision to move. The cost, however, against which these welfare levels are compared in the decision-to-move may not be the same in either case. Further work remains for a complete understanding of the decision-to-move and its causes.

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