RESEARCH REPORT

The Application of Economic Indifference Curve Theory to the Cost of Housing for Seniors: Some Observations

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THE APPLICATION OF ECONOMIC INDIFFERENCE CURVE THEORY TO THE COST OF HOUSING FOR SENIORS: SOME OBSERVATIONS

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For :
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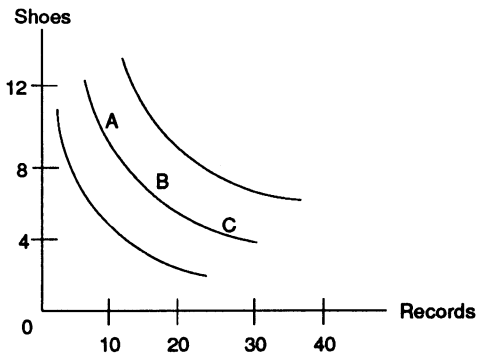
The Application of Economic Indifference Curve Theory to The Cost of Housing for Seniors: Some Observations

The purpose of this note is to explore some of the problems associated with the application of traditional economic theory to the estimation of the cost of housing for seniors. The note begins with a non-technical description of indifference curve theory, the basic building block of most economic discussions of consumer demand. It then examines how this can be applied to the demand for housing by one population sub-group, seniors, and how some unique characteristics of the seniors add complexity to the basic model. The Paper goes on to explore the conditions for moving from indifference curves to an aggregate demand curve, and how this process is again affected by the specific nature of the senior's demand for housing[1].

I. INDIFFERENCE CURVE THEORY

Economic analysis uses the concept of indifference curves in order to establish the basics of consumer choice. Consumer choice theory assumes that individuals are able to choose rationally between competing goods. As an example, consider an individual who has a choice between shoes and records. Utility analysis looks for that combination of shoes and records that would give him equal levels of satisfaction. In general, as long as both goods are desirable, and the consumption of one does not require the consumption of the other, comparing possible combinations would involve more of one good and less of the other. In terms of Graph 1, point B would have to lie to the right and below point A, for both A and B to offer equal utility.



Graph 1 Indifference Curves

Thus, utility analysis assumes that an individual consumer can choose rationally between competing goods.

For most persons, each additional unit of shoes will produce marginally less utility. If he has 2 pairs of shoes already, he would be willing to give up 1 pair in order to buy 3 records; in economic parlance, the rate of substitution between shoes and records is 1:3. If he has 6 pairs of shoes, he would be willing to give up one pair in order to acquire 2 records: the rate

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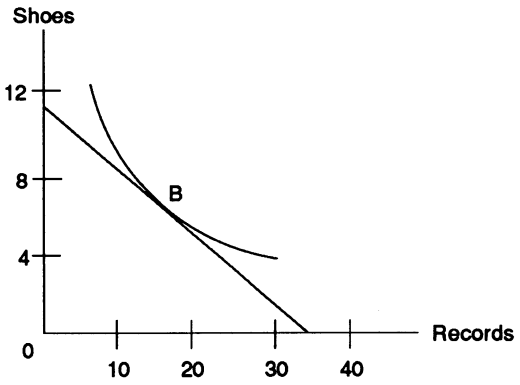
1 CMHC's Market Analysis Division has commissioned Prof Park to develop an econometric model of the Canadian Housing Market.

of substitution is 1:2; and if he has 10 pairs of shoes, he would trade 1 shoe for 1 record. Thus the line connecting these three sets of possibilities would be convex to the origin. The consumer would face a whole range of indifference curves, with the only logical requirement being that such curves not intersect.



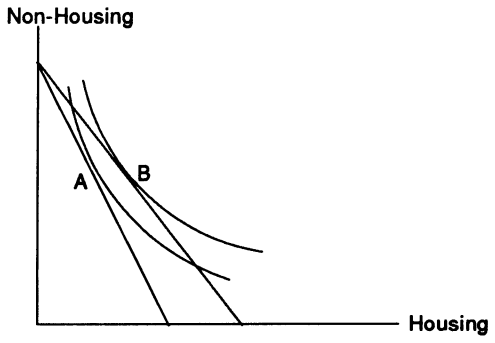
Graph 2 Budget Line

The third stage of utility analysis compares this indifference curve to what he could buy, what is termed his budget line. The income he has to spend on shoes and records, and how much shoes and records cost determine the shape and position of the budget line. Assume shoes cost $50 per pair, records cost $15 per disk, and he has a total of $500 to spend on both records and shoes. If he bought only shoes, he could buy 10 pairs; if he bought only records, he could buy 33 records. The straight line connecting these two points represents all possible combinations of records and shoes that he can buy. Thus, any point to the outside of this line relative to the origin and the axes cannot be purchased; any point to the inside can be purchased. Maximizing his utility, he would settle at that point/curve just tangent to the budget line.

Thus, indifference curve analysis assumes that a budget line exists, and that it is reasonably well-defined and fixed.

In applying this analysis to housing, economists such as Richard Muth generally differentiate between housing and all other goods, all joined together into a single, composite product. They can then use this model to arrive at some theoretical conclusions about housing.

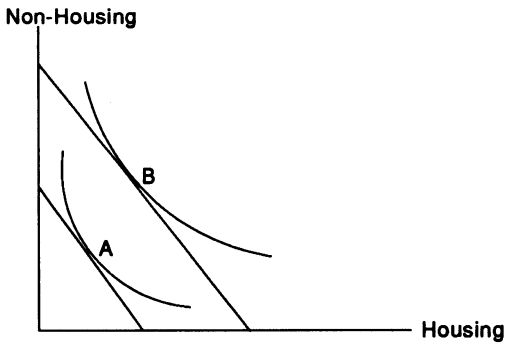
One such conclusion has to do with the effect of an increase in the price of housing. If the price of housing increases, the budget line will rotate inward: the consumer could still buy the same amount of everything else, but less housing. As a result, he would be at an equilibrium point that involves less housing and possibly less of everything else. The exact extent would depend on the actual shape of the indifference curve. An example of price increases would be a special tax on housing.



Graph 3 Effect of Price Change

A second theoretical conclusion involves the effect of a change in income. In this case, the budget line shifts outward, parallel to the original budget line since relative prices have not changed. He would

consume more housing and more of other goods as well. An example of an income increase would be a reduction in the rate of income tax.



Graph 4 Effect of Income Change

To this point the model is fairly general, and can be applied to any commodity, if one can accept the basic assumptions outlined above. It is in the operationalization of the model that housing raises unique problems.

The first problem regards the definition of the commodity that we call housing. In general, economists differentiate the concept of stock of housing from that of housing services. The stock is that which is in place at a given point in time. In 1991, there were a total of approximately 10 million housing units in Canada.

However, housing stock, though built within a short time frame, is actually consumed, in the sense of its being used up, over a very long time frame. As a result, the stock of housing cannot be viewed as that which is consumed in the "current period" of one year. Consumption is viewed by most economists as a flow of housing services, and these housing services are generated by the stock of housing. Frequently, this is represented incorrectly by additions to the stock; in 1991, 160,000 new units were completed.

Some analysts have used housing expenditures as a measure of housing services. For the renter, expenditures on the services used in housing are equivalent to the rent paid. However, for the owner occupier, it becomes necessary to estimate these expenditures. This is usually done by summing:

monthly mortgage interest payments
opportunity cost of equity in the home
maintenance
depreciation, and
decline in house price.

These items, like the rent paid by the tenant, all represent expenditures, rather than quantity of services consumed. Algebraically,

$$\text{EXPENDITURE} = \text{SUM}\ \{P(i) * Q(i)\}$$

where: P(i) is the price of the ith service
Q(i) is the quantity of the ith service

Since the concept of 'a unit of housing service' has never been clearly defined, it is impossible to attach to it a price. Moreover, it must be recalled that in indifference curve analysis, the indifference curve is based on quantities and the budget line on price; merging the two makes it impossible to use indifference curves for the analysis of trade-offs between

individual services. It is for this reason that Muth groups all housing services together and contrasts it to a composite non-housing good.

There are two ways in which the problem of using expenditures rather than quantities has been resolved. One way is to assume that the price of housing services is fixed, so that housing expenditure is a linear transformation of the sum of the quantity of services. If we use service 't' as the numeraire, then

$$P(i) = k(i) * P(t)$$

where k(i) is a constant

$$\text{SUM}\{P(i)*Q(i)\} = K * P(t) * \text{SUM}\{Q(i)\}$$

where K is a constant, the sum of the k(i)'s.

While the assumption of fixed relative prices may be true for a single market at a single point in time, it is hard to accept for different markets or for different time periods.

The second approach is to not use expenditures, but to assume that all of these services are consumed in constant proportions to each other, so that one can use a single service, such as floor space, to represent all the services. A notable exception would be the quantity of land consumed, particularly as between detached and high rise housing; this has led economists to develop models of city structure and rent gradients. A second exception is the form of tenure itself. If tenure is merely viewed as a way of holding an asset, and thus an investment decision, then tenure should not affect the flow of services. However, if tenure *per se* is a desirable characteristic of housing, then it is hard to see how one can expect tenure to be a constant proportion of floor space.

Neither of these two solutions are very satisfactory for dealing with complex situations, though they do allow one to proceed to the next stage of the analysis, which is the generation of a demand function. Before doing this, however, we shall first see how the housing situation of the elderly further complicates the housing decision.

II. APPLICATION OF THE MODEL TO HOUSING FOR SENIORS

In applying the indifference curve model to seniors, the question that must be answered is whether senior's housing is different from the housing of any other group, if so, how, and finally what difference does it make to the analysis. There are three ways in which senior's housing can be view as different.

One way in which it may be viewed as being different is that seniors usually face a significant drop in income as a result of retirement. Even before retirement, incomes for some may fall if they are laid off. Because of a perceived view that the elderly are less able to do work-related tasks, and because of the high cost of retraining, it is often difficult to find new work. The rapid change in the work place, with its shift to high-technology and computer-based jobs, makes it difficult for those not trained in such technology to be retrained.

This requires us to rethink how we should approach the income constraint in the budget line of the previous analysis. With regard to the general population, most economists now accept the concept of permanent income, roughly the income one expects to earn over a specific time frame. The general approach is to calculate average income over a multi-year period; in the past, most studies have found that the ratio of housing expenditures to average multi-year income is much more stable than the ratio of current expenditures to current income. To accurately estimate permanent income, it would be necessary to have a longitudinal database. Lacking such a database, some economists have used trends in income for some reference group as a proxy for what the individual might expect. Even with a longitudinal database, it is possible that permanent income would not be correlated with housing expenditures since much of irregular, or windfall, income, might also be set aside for purchasing more housing. In the US, the Experimental Housing Programs provided some of the best longitudinal data on housing, though even these have been criticized because the experiments may not have been viewed as permanent by the participants. Since much of senior income is pension income, permanent income is probably not as hard to forecast as for the general population.

Secondly, income alone is not involved, as one can use up assets as well. The difficulty is estimating to what extent assets would be used. For seniors, one might postulate that they would be more willing than non-seniors to use up their assets because of their shorter expected lifetime, though there is no evidence of the extent to which they use up their assets. Reverse Annuity Mortgages are designed to encourage the using up of the asset value of the home. The using up of assets would make it much more difficult to identify a budget line.

Moreover, seniors receive numerous in-kind benefits, such as health care, public transit etc. Apart from the problem of estimating the amount of such goods, there is a conceptual problem regarding how to value such benefits: at their cost of production, at the cash equivalent amount, or at how much a senior would actually pay for that service? Regarding health care, not only is the senior acquiring free health care, but he is also receiving the peace of mind that such services will be available when needed. Seniors also appear to receive more free services from voluntary agencies and may receive funds from, or give funds to, children not living at home.

Finally, the distribution of income among seniors is more skewed than that of the non-senior population . Thus, looking at the income for seniors on average would distort the actually income situation of those far from this average.

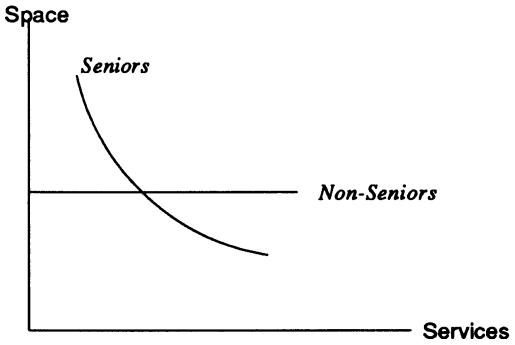
Thus, the income line for a senior would be affected by:

- different perception of real income, as the household becomes aware that its income will drop; this perception likely occurs several years before retirement as it begins to plan for retirement or is laid off, and is also affected by the fact that, for households with two or more income earners, this drop in income will be phased over several years
- growing willingness to use up assets, because of the realization that life expectation is no longer infinite

- an inequitable distribution of income and assets.

For all of these reasons, the use of a fixed budget line is not a very useful assumption with regard to housing for seniors.

A second way in which seniors housing may be different is that a change in the structure of the family occurs, for those households with 2 spouses and/or children. As the children leave the house, the preference for space may be replaced by a preference for other housing services, or for non-housing items. In the former case, the mix of housing services will shift, while in the latter case, the utility curve itself rotates, as the trade-off between housing and non-housing changes. While such a phenomenon can be easily handled theoretically, in a model which looks at different services in isolation, it is hard to incorporate into a model in which all housing services are grouped together into a single composite good.



A third way in which housing for seniors is different is the extent to which support services become important as the capacities of some seniors decline. With ageing comes a "non-uniform set of progressive changes in physiological and psychological functions" such as:

-difficulty to undertake house maintenance, snow removal and yard work

-fear of bodily harm or loss of property from criminal activity

-possible lack of companionship as other seniors leave the neighbourhood through death or moving

-greater difficulty in using transportation to access shopping and medical facilities as confidence in driving one's own automobile declines

-fear of what will happen in case of an emergency

-fear of losing a spouse and/or being a burden on one's children

-decline in muscle tone and in physical size

-susceptibility to accident, such as falling on stairs, and the greater time it takes to recover

-viewing meal preparation as more of a burden if just for oneself, and consequently a poorer diet

-loss of memory , ie, slower speed of recall, shorter memory span

Living in older homes, in older, often poorer neighbourhoods, and with less income to undertake repairs may also contribute to the possible increase in accidents.

The infirm are generally a small proportion of the elderly; roughly 2 per cent of all those over 65 are bed bound; most of these are probably among the 5 per cent of the over 65 population who are in institutions. Of those living at home, approximately 10 percent require assistance with one or more of their activities, though this ratio increases for older age groups. For those requiring services, housing services would now include those support services that are now provided in the house.

Some of the support services which the senior starts to consume include:

A. Physical Health

- Medical
- Dental
- Physiotherapy
- Chiropody
- Rehabilitation
- Chiropractor
- New Medical Approaches
- Drugs
- Clinics
- Hospitals
- Home Nursing

B. Mental Health

- Crisis Management Counselling (for elderly and their children)
- Physical Abuse Prevention

C. Aids for Daily Living

- Home and Personal Care
- Shopping
- Meals (individual, congregate, and on-wheels)
- Public facilities with ramps
- Telephone reassurance
- Friendly visits
- Volunteers

D. Work and Income

- Finding work
- Budgeting
- Tax filing
- Filling out forms

E. Transportation

Public transit (fares, accessibility, frequency)
Volunteer chauffeuring

F. Others

Libraries, talking books, and large print
access to information

G. Home

Maintenance, indoor and outdoor
Barrier removal

All of these services start to become adjuncts to the set of housing services normally consumed by the household. Incorporating them within the indifference curve analysis becomes extremely difficult.

III. ESTIMATING A DEMAND CURVE

Beginning with the indifference curve model identified in the first section, and adding a number of fairly restrictive assumptions, many economists have come up with a model that explains housing expenditures as a function of income, price and a host of other variables. In arriving at the particular functional form and variables to be used, unfortunately, numerous economists tend to be guided by what data are available, rather than what is required from the theory; but, excluding important variables can result in biased estimates of the relationship.

The simplest equation is:

$$P(i) * H(i) = a0 + a1 * Y(i) + ui$$

where: P (i) is price of housing

H (i) i quantity of housing

so that P(i) * H(i) is housing expenditure

Y (i) is current income

u (i) is a randomly distributed error term

a0 and a1 are estimatable parameters

As mentioned above, economists prefer to use permanent income. This has usually been estimated by using an average of past real income, an approach which is unlikely to be reliable for seniors. Alternatively, they have used a set of instrumental variables, such as age and education to represent income either in a two stage process or directly; in this case, income is in fact determined by so many factors, that identifying only a few will result in biased estimates. Even if one could accurately estimate permanent income, there would be the problem of incorporating the use of assets and the non-linear effect of various tax rules, such as capital gains taxation.

One major problem with the above demand function is that it assumes no variation in price, so that one can use expenditure rather than quantity. The difficulty is that there are no good measures of price. One method is to use the costs of construction, but this is generally unsatisfactory insofar as it assumes the market is in equilibrium.

A third problem is that of aggregation. Until recently, many studies relied on aggregate data since they were readily available. Aggregation was usually done at the census tract level, but this is not a random allocation, which is an *a priori* requirement in using aggregation. Consequently, the error in the estimation can be quite significant.

Despite these problems, numerous estimates of the coefficients of the housing demand equation have been made. The coefficients on income tend to vary from as low as 0. 1 to as high as 1. 5, though they average around 0. 5. In other words, a 1 percent increase in real income is expected to result in a 0. 5% increase in housing expenditures.

IV. SUMMARY

In this Note, I have reviewed the traditional model used by economists for explaining consumption. Not only do I feel that the model is weak when applied to housing in general, it is especially weak when applied to housing for seniors. The major reasons for these weaknesses relate to:

-the budget line is not fixed
-there is a shift in lifestyle, including greater demand for services, and
-the requirements for a demand function, particularly identifiable price and quantity, and meaningful aggregation, are not met.

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