Recreational Time Values in Household Production Model: A Synthesis Under Leontief Teontief

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There has been several recreational demand models derived from Becker's household production framework. Based on Beck's framework, choice process of utility maximization is completed in two stages. In the first stage, individual minimizes the cost of production on recreatonal activities subject to the output function and technology. In the second stage, the individual maximizes his/her utility by choosing different number of recreational trips and other commodities subject to budget and time constraints. By assuming Leontief technology, this paper synthesizes these recreational demand models into a compact one. Previous studies are shown to be some special cases in this synthesized recreation model.

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Time cost has been an important issue in recreational models. Accounting for travel time and on-site time are important because both represent the use of a scarce resource implying a positive opportunity cost. In turn, the issue in considering these opportunity time costs is how to incorporate and value time in the recreation demand function. Some researchers proposed an explicit money cost to be imputed to scarce travel time (Cesario and Knetsch, 1970). In other studies, by applying Becker's household production model, travel time and on-site time were considered as variables in the choice process of utility maximization (e.g. Bockstael et al., 1987; McConnel and Strand, 1981; Jeng and Hushak, 1989). Although all of these studies applied household production framework, their recreational demand functions do not appear exactly the same. Theoretically, these models should be summarized into a compact one.

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Household Production Framework Applied to Recreational Studies

Becker's household production framework is a theory of choice in which purchased goods are one of the inputs into the production of "commodities" that directly enter the utility function. In this framework, house hold decision making is concerned with the efficient use of market goods, time, and human capital as inputs in the production of utility yielding non-market goods, such as recreational trips.

The household optimizes the choices in two stages. It is assumed that the recreational trips are the only category of household output that requires time input. In the first stage, the household minimizes the cost of production subject to the output function and technology.

(1) $\text{Min } C = \sum_i Px_i X_i + \sum_i w_i$

s.t. $Z_i = Z_i (X_i , i ; k_0), i = 1,...,m,$

where Z_i = number of recreational trips,

C = full cost of producing recreation trip,

X_i = a vector of market inputs in producing a trip,

Px_i = price of X_i,

i = time input in producing Z_i,

k_0 = technology level, and

w = wage rate.

In the second stage the individual maximizes his utility by choosing Zi's and other commodities subject to budget constraint and time constraint.

(2) $\text{Max } U = U(Z_1, \ldots, Z_m, Z_0)$

$$\text{s.t. } \sum_i Px_i X_i + \sum_i w_i = wT + E$$

$$\sum_i i + t_w = T$$

where t_w = work time,

T = total time, and

E = non-wage income.

Zo = composite commodity other than Z_1 to Z_m.

The term (wT + E) measures full income, which would be realized if all time were devoted to work and wage rate were constant. This framework assumes that the work time(t_w) and the time input for recreational trips(i) are perfect substitutes. Therefore, i is valued at the wage rate. Conceptually, we can find different values of time inputs by the derived input demand function for time.

Recreational Household Production Model Under Leontief Technology

Bockstael et.al.(1987), McConnell and Strand(1981), Jeng and Hushak(1989) are special cases of the household production framework applied to recreational studies. By assuming a Leontief, fixed-proportions technology, i.e. Z's have fixed time and money costs per unit, either the time per se is the cost (a corner solution) or the opportunity cost of wage income is the time cost (an interior solution).

The assumption of Leontief production technology condenses the two

stage model into a compact one. For the individuals at the corner solution, the utility maximization problem becomes:

(3) $\text{Max } U(Z_1,...,Z_m, Z_0) + \mu_1 (Y - \Sigma Px_iX_i) + \mu_2(T - \Sigma iZ_i)$

where $Y = E + wt_w$. The first condition gives (4) $\partial u/\partial Z_i = \mu_1$. Therefore, the recreation demand function is

(4) $Z_i = Z_i (Px_i, i, Px_j, t_j, Y, T)$

where j represents substitute sites. We can see that time itself is a cost for the recreational demand. A problem exists for the corner solution. In equation (4), recreational time, travel or on-site, are highly correlated with the price/cost variable.

For the interior solution, at least some component of work time is discretionary and the time constraint can be substituted into the income constraint.

(5) $\text{Max } U(Z_1,..., Z_m, Z_0) + \mu_3 [Y + W_DT - \Sigma(Px_i + W_Di) Z_i]$

where W_D = wage rate applicable to discretionary employment. The recreation demand function is:

(6) $Z_i = Z_i (Px_i + W_Di, Px_j + W_Dt_j, Y + W_DT)$

Here time is valued at opportunity money cost in the function.

McConnell and Strand is a special case of the interior solution in Bockstael et.al.(1987). In their study, M&S specify the recreation demand function as

$$(7) \quad Z_i = Z_i(Px_i + W_D i, S, M)$$

The value of discretionary employment W_D is set equal to the value of recreation time and is separated into k^* v,i.e. $W_D = kv$

where v = marginal discretionary wage,

k = % of the discretionary wage at which recreational time is valued. By specifying a linear demand function

$$(8) \quad Z_i = Z_i(Px_i + kvi)$$
$$= a_o + b_o(Px_i + kvi)$$
$$= a_o + b_o Px_i + b_i(vi)$$

The estimate of k can be obtained by calculating

$$(9) \quad k = b_1 / b_o$$

Jeng and Hushak (1989) developed a modification of the McConnell and Strand recre-ational demand model which allows demand behavior to vary among individuals. In particular, they propose that the value of recre-

ational time is affected by the individual's demographic characteristics. Each individual values recreational time is a function of each individual's socio-psychological characteristics. Equation (8) can be generalized as

(10) $Z = Z[TC(D), P_v, Y, \beta(D)]$

where

(11) $TC(D) = P_r + k(D)t_i a$

If k is a linear function of the demographic factors, then

(12) $k_i = k_i(D) = \tau_0 + \Sigma \tau_j d_{ji}$

describes the percentage of average income at which individual i values recreational time as a function of j demographic variables. With a linear functional form, the modified M&S recreation trip demand can be written as:

(13) $Z_i = b_0 + b_1 TC_i(D) + b_2 Px_i + b_3 Y_i$

(14) $= b_0 + b_1[\, Pz_i + k_i(D)t_{ti}a_i \,] + b_2 Px_i + b_3 Y_i$

(15) $= b_0 + b_1 Pz_i + b_1(\tau_0 + \Sigma \tau_j d_{ji})t_{ti}a_i + b_2 Px_i + b_3 Y_i$

(16) $= b_{ii} + b_1 Pz_i + \beta_5 t_{ti}a_i + \Sigma \beta_{6j} d_{ji} t_{ti}a_i + b_2 Px_i + b_3 Y_i$

This gives the percentage of recreational time values as

$$(17) \quad K_i = (\partial Z \partial / t_i a)/(\partial Z/\partial P_j) = (\beta_5 + \Sigma \beta_{6j} d_{ji})/b_i$$

If the demographic variables have no effect on the individual's valuation of recreation time, then β_{6j}'s are zero and the modified demand function reduces to the M&S model.

Conclusion

By applying Becker's household production model, travel time and on -site time were considered as variables in the choice process of utility maximization. The household optimizes the choices in two stages. In the first stage, the household minimizes the cost of production subject to the output function and technology. In the second stage the individual maximizes his utility by choosing different number of recreational trips and other commodities subject to budget constraint and time constraint. The assumption of Leontief production technology condenses the two stage model into a compact one. By assuming a Leontief, fixed-proportions technology, i.e. Z's have fixed time and money costs per unit, either the time per se is the cost (a corner solution) or the opportunity cost of wage income is the time cost (an interior solution). Previous studies are shown to be the special cases of the household production framework applied to recreational studies.

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家計生產模式中之遊憩時間價值—Leontief 技術下之綜合模型

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Becker之”家計生產模式”曾被廣泛地應用於遊憩需求研究上。該模式係將遊憩者追求效用最大的行爲分成兩個階段。首先遊憩者在生產及技術之限制下追求成本最小；其次爲遊憩者在所得及時間之限制下選擇旅遊次數以達成效用最大。由過去之文獻來看，雖然各研究均基於家計生產模式推導遊憩需求函數，卻由於各研究之著重點不同，所推導出之遊憩時間價值評估方式則互異。因此在理論推導上應可將其合而爲一，形成基本模型。

在假設Leontief生產技術之下，本文推導出一個綜合理論模型，其適用的狀況較爲廣泛。過去各研究對遊憩時間價值之評估方法均可證明爲此綜合模型之特例。

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