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ESTIMATING THE TIME SPENT ON SHOPPING ACTIVITIES

by

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ABSTRACT

This paper represents an attempt to constract a unified model of shopping behavior by drawing on the households production approach. A formal treatment is presented that takes into account the explicit relationships between consumers' temporal and monetory resources, stage in the family life cycle, their subjective shopping preferences, and shopping behavior. Emerged propositions make the study of time use for shopping increasingly amenable.

INTRODUCTION

Time is rapidly assuming a central place in consumer analysis (e.g., Feldman & Hornik, 1981; Jacoby et al., 1976). This development reflects, among other things, the increasing awareness that many consumption activities require the use of scarce resources such as energy, information, money, space, and time. Shopping in one consumer activity which requires expenditures of most of these scarce resources. Of the various resources involved in shopping, time has been researched the least, although in most writings one would find the arguments that a shopping activity is a time-consuming activity (Berry, 1979; Granbois, 1977).

Shopping, traditionally the domain of women, is being assumed to a varying degree by males in a growing number of households. American households spend, on the average, about five hours a week for shopping in about three shopping trips. Sixty-three point four percent of this shopping time is spent by the wife alone, 27% by the husband and wife, and 9.5% by the husband alone (Hendrix, 1978). It has been shown that consumers life cycle explain variations in time spent on shopping activities (Rich & Jain, 1968). Also, that consumers are likely to spend more time for shopping activities if they place a high value on the benefits to be gained from such an activity relative to the benefits expected from other (nonshopping) activities (Bucklin, 1966).

The intent of this note is to outline a theoretical scheme and formalize the structure in which decisions to allocate time for shopping activities can be understood.

THEORETICAL FRAMEWORK

The theoretical base of this paper draws on a modified economic production function model (Etgar, 1978; Gronau, 1977); on the life cycle concept in consumer time behavior (e.g., Landon & Locander, 1978); and the subjective preference propositions in time use studies (e.g., Hornik, 1982). To this end, a formal treatment of a dynamic shopping model will be advanced that takes into account the explicit relationships between consumers' resources and their subjective preferences. Such a theoretical structure would seem to bring time use squarely into the spotlight as a determinant of shopping behavior.

The Household Production Function

The household production approach in consumer theory emphasizes the fact that market goods and services are not themselves carring utility but are rather inputs in a process that generates commodities (or characteristics) which, in turn, yield utility. A second feature is that market goods and services are not the only inputs in this process, the other input being the consumer's time. According to this economic approach (Becker, 1965) the consumer maximizes utility subject to the time and budget constraints where utility is a function of commodities, which are produced using market goods and time.

This approach was extended to explain consumer behavior in diverse situations such as church attendance (Azzi & Ehrenberg, 1975), demand for health (Grossman, 1972), education (Michael, 1973), and transportation (Gronau, 1970). Such a framework can be used also for considering how consumers may determine their shopping activities.

According to the economic approach consumers will assign values both to the benefits of shopping and the cost of time, effort, and money involved. The extent of the shopping activity (frequency and duration) is thus determined by the marginal rate; shopping continue until the value of additional unit of shopping is equalled by its cost. Individual differences occur because consumers differ in their value of time, which is thought to be subjectively valued according to the opportunity cost role--the greater the number of activities competing for a unit of time, the greater its value. Time is further valued by its relationship with income, to the extent that time and money can be thought of, as at least partly, substitutable resources. For this reason the value of time becomes greater as one's income increases and the value of the next (marginal) dollar decreases.

Models of household production also recognize that the value of time changes for a household at various stages of its life cycle, and these changes include substitution toward relatively cheaper input factors of production. When income, and consequently the value of time, is relatively high, the individual works more, has less free time for shopping, and generally behaves in ways which conserve time and use money relatively intensively.

The Household Life Cycle

In their study of time as a measure of household productivity, Walker & Woods (1976) noted that household production changes over time within a given family. "The family is not a static entity but goes through stages of growth and contraction, with each stage requiring a different 'mix', quantitatively and qualitatively, of goods and services to meet the needs of family members" (p. 8). Therefore, by knowing the life cycle stage of the household, it would be possible to predict how much time would have to be spent to produce the goods and services a family needs to function as a unit (Ferber & Biranbaum, 1977).

Family life cycle (FLC) appears to have much potential for explaining time behavior because it is both multidimensional and dynamic (Landon & Locander, 1978). Its multidimensional nature is attributed to the fact that FLC is a composite of several important demographic variables. FLC is dynamic because it accounts for the changing family needs and structure over time. Arndt & Gronmo (1977) in their treatment of time in shopping behavior explicitly recognize the importance of FLC as a determinant of time devoted to shopping activities. In addition, they speculate that shopping may satisfy various consumers' subjective needs such as diversion, self-gratification, and social interaction.

Subjective Preferences

Time in the household production function literature is only important as a scarce input which must be allocated among alternative activities. The tangible outputs of these activities comprise the arguments of the household utiity function (Gronau, 1977). Therefore, the pattern of time allocation for consumers influences shopping activities only through the production and consumption of commodities, not through derived gratifications from shopping activities themselves. Robinson (1977), using a measure of satisfaction derived from activities said (p. 191): "We suspect that even daily routine evolved from a process in which individuals selectively find those activities that are psychologically rewarding and arrange their lives in such a way that participation in these activities can be scheduled more frequently."

Shopping trips may involve gratifications considerably beyond the primary functions of search and exchange. Some motives for shopping include diversion and recreation, self-gratification and reward, learning about new trends, physical activity or exercise, and sensory stimulation, as well as the satisfaction of performing an activity seen as an integral part of one's role

(Granbois, 1977). Social motives involve social experience such as, encounters with friends and watching other people, communication with others having a similar interest, peer-group attraction (such as teenagers find in record stores), the opportunity to command attention and respect by being "waited on", and the pleasure derived from bargaining (Tauber, 1972). An implied proposition here is that shopping activities may well be perceived and valued differently by different consumers depending on their subjective preferences and whether the activity is felt to be one of only immediate gratifications, or rather one of "investment" in some long-term socio-psychological fulfillments. Moreover, different shopping activities have different functions and characteristics and therefore, might correspond to different temporal behavior.

THE BASIC MODEL

The proposed model rests on the theory of choice under uncertainty. A central proposition in the theory is that if, in a given period, two activities are mutually exclusive, one will choose between them by comparing their expected utilities. This proposition suggests that consumers spend shopping time as if they were to maximize their expected utilities subject to environmental constraints and personal limited resources. It is further assumed that consumers confronted with choice situations behave as if they sort out and arrange their preferences, which, in turn, direct their choices. Thus, this assumes a quasi-concave utility function:

$$U_1 = U(Z_1, Z_2, \ldots, Z_t, \ldots, Z_n, e) \qquad [1]$$

Where Z_t represents peoples consumption in period t, and e the expected value of a shopping activity. It is assumed that the individual consumer knows his/her current and future market wages, which are taken as predetermined in

the model. Consumption in period t is expressed by the production function which transforms the consumer's purchases of a composite market good x and the time allocation h to consumption into units of the final consumption commodity (Z). The function is assumed to be the same in each period and to be continuously differentiable and concave:

$$Z_t = Z(x_t, h_t) \text{ for all } t \qquad [2]$$

Expected benefit of shopping activities are assumed to be continuous differentiable, concave function of the time spent in shopping (h'):

$$e=e(h'_1, h'_2, \ldots, h'_n) \qquad [3]$$

Let p stand for the price of the market good in any period of time, w for the wage rate in period t, i for a constant market rate of interest, v for other (non labor) sources of income in each period, and l for hours of work in t. Assuming that the consumer intends to leave no estate, his lifetime discounted income constraint is given by:

$$\sum_{t=1}^{n} [px_t/(1+i)^{t-1}] = \sum_{t=1}^{n} [(v+w_t l_t)/(1+i)^{t-1}] \qquad [4]$$

If T is the stock of time available per period, the consumer's time constraints is given by:

$$T=h_t + h'_t + l_t \qquad [5]$$

where $h_t\ h'_t\ l_t \geq 0$ for all t.

The preceding comprise a well-defined maximization problem. The production function can now be substituted into the utility function [1] to

yield a composite function, and the time constraint can be solved for l_t and substituted into [4] to yield a "full-wealth" constraint. Taken together the functions allow the use of the Lagrangian function for the problem:

$$L_1 = U[Z(x_1, h_1), Z(X_2, h_2),\ldots,Z(X_n, h_n), e(h_1',\ldots,h_n')] \qquad [6]$$
$$+\lambda\{\sum_{t=1}^{n}[px_t/(1+i)^{t-1}] - \sum_{t=1}^{n}[v+w_t l_t)/(1+i)^{t-1}]\}$$

substituting the time constraints results in

$$L_1 = U[Z(x_1, h_1),\ldots,Z(x_n, h_n), e(h_1',\ldots,h_n'] \qquad [7]$$
$$+\lambda\{\sum_{t=1}^{n}[px_t/(1+i)^{t-1}] - \sum_{t=1}^{n}[v+w_t(T-h_t-h_t')/(1+i)^{t-1}\}$$

The first order condition require that at the optimum

$$\frac{\partial e}{\partial h_t'} = W_t \text{ for all } t \qquad [8]$$

If it is assumed that the consumer faces constant wage rates over lifetime, the first-order conditions require that at the optimum:

$$\frac{(\partial e/\partial h_t')}{(\partial e/\partial h_{t-1}')} = (1+i)^{-1} \text{ for all } t \qquad [9]$$

Life Cycle

The condition above requires that consumers reallocate their time toward shopping activities with advancing age. If, for a consumer, the marginal product of an additional unit of time for shopping is the same in period t-1 and t, when he/she devote the same amount of time to shopping activities

during the two periods, then equation [9] implies that the number of time units per period allocated to shopping increases with age.

Empirical studies report a distinctive curve of shopping associated with FLC (Rich & Jain, 1968). In the early family years (newly married), shopping time is generally low, rising during middle years (full nest), and declining later FLC (empty nest). The explanation has been that in early FLC consumers are unsettled, mobile, no children, etc. Advanced age, on the other hand, brings fatigue and social withdrawal that lower the rate of shopping activities. More shopping time comes with extended residence, home ownership, children in school, etc. (Granbois, 1977).

The discussion so far is based on the assumption that one's wage rates are constant over lifetime. However, if for two adjacent time periods a consumer's wage rate varies, equation [9] becomes:

$$\frac{(\partial e/\partial h_t')}{(\partial e/\partial h_{t-1}')} = (W_t/W_{t-1})(1+i)^{-1} \qquad [10]$$

Thus, all other things equal, the more rapid the rate of wage increase, the slower the rate at which units of time allocated to shopping activities will increase with age. In other words, when consumers' marginal costs of investing in shopping activities rise less rapidly with age, they will allocate more time to shopping.

The effect of a change in nonlabor income on shopping can also be calculated under the conditions of uptimality; an increase in nonlabor income leads to an increase in the time allocated to shopping, that is $\partial h'/\partial v > 0$.

The Gratification Effect

While the preceeding analysis has been simplified by ignoring subjective consumer preferences among shopping activities and gratifications derived from

such action, the following utility function takes these into consideration expressed by:

$$U_2 = U_2(Z_1, s_1, \ldots, Z_n, s_n, e) \qquad [11]$$

where s_t is the subjective consumption value of shopping activities in period t. The function is assumed to be continuous concave, and to represent the consumer's time allocation to shopping during the period:

$$s_t = s_t(h_1', h_2', h_n') \text{ for all } t. \qquad [12]$$

By way of substitution we obtain:

$$L_2 = U_2[Z(x_1, h_1'), s_1(h_1', \ldots, h_n'), \ldots, Z(x_n, h_n'), s_n(h_1', \ldots, h_n') + \lambda\{\sum_{t=1}^{n} [px_t/(1+i)^{t-1}] - \sum_{t=1}^{n} [v+w_t(T-l_t-h_t')/(1+i)^{t-1}]\} \qquad [13]$$

Clearly, the previous implications concerning the impact of wage rate and nonlabor income on shopping time remains unchanged. However, the implication of equation [10] with respect to intertemporal allocation of time to shopping is given by:

$$\frac{[(\partial U/\partial s_t)(\partial s_t/\partial h_t') + (\partial U/\partial e)(\partial e/h_t')]}{[(\partial U/\partial s_{t-1}(\partial s_{t-1}/\partial h_{t-1}') + (\partial U/\partial e)(\partial e/\partial h_t')]} =$$

$$= [(w_t/w_{t-1})(1+i)^{-1}] \text{ for all } t. \qquad [14]$$

That is, even if a consumer faces a constant wage rate during the two periods, there may no longer be any reason for proposing that shopping time should increase with FLC because of the subjective elements in the activities. However, if the expected value of the activity is significantly more important than immediate satisfaction, the previous implications would hold. Formally this requires $\partial U/\partial e$ to be substantially larger than $\partial U/\partial s$ for

all t. Thus, factors which increase the current gratifications that consumers derive from a shopping activity would lead to an increase in the time allocated to shopping.

DISCUSSION

This paper presented a formal model of consumers use of time for shopping. Drawing primarily on the production function approach, the paper treats the cost of time as the costs of market goods in a model of choice. By viewing time as a resource, an intertemporal utility maximization model was developed which includes propositions concerning the optimal allocation of time and the shape of shopping activities throughout the FLC. Whereas some of the model's implications are congruent with the more recent empirical evidence (e.g., Arndt & Gronmo, 1977), others call for a more critical examination of short-term changes in time spent for shopping. Thus, one of the model's implication is that, all other things equal, the more rapid the rate of wage increase, the slower the rate of which time allocated to shopping activities will increase with age. Even if the consumer forces a constant wage rate during two or more periods of time there is no compelling reason to suggest that shopping time should increase with FLC because of possible variations in immediate gratifications derived from the activity. This suggests that wage-earning profiles rather than cross-sectional comparisons of income might be better predictors of the amount of shopping time. In fact, the model predicts that consumers facing an upward-slopping age-earning profile will decrease the time intensity of their shopping activities over the course of their life cycle. This could be achieved, partly, by reallocating their time toward less time-intensive forms of shopping. In other words, consumers may substitute more time intensive shopping activities for less time intensive ones. They

may, overtime, adopt a whole new set of shopping behavior as shopping technology enables them to derive the same basic set of shopping benefits with less time and more money. For example, to replace conventional food stores with in-home shopping (Cunningham & Cunningham, 1973), use convenience store (e.g., 7-eleven), patronize less crowded stores (Berry, 1973), switch to catalog and/or mail order shopping, or even use personal "errand" services ranging from shopping for parties to picking up consumers' dry cleaning.

Conclusions

The model presented here was intended to serve two functions. First, to highlight some of the temporal dimensions in shopping activities. Second, to serve as a catalyst for future research in related subjects.

Additional insight is necessary in order to determine the generalizability of the model to different shopping situations. As noted earlier, some shopping activities provide basically immediate benefits in the form of search and exchange. Others contain more enduring socio-psychological gratifications. For example, shopping for soft goods such as clothing and yard products seem to be relatively more involved and provide some of the mentioned socio-psychological elements. On the other hand, food shopping offers less psychologically gratifying but a means of acquiring needed economic resources and therefore requires more frequent but shorter shopping trips. Also, to gain insight into the "window shopping" phenomenon where time spent, at least partially, is to search for market information.

More ambitious endeavors, such as the estimation of the household production function and the value of different shopping activities might be advanced. Given the right data, it is hoped that this model will facilitate their realization.

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