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THE ALLOCATION OF TIME: YOUNG VERSUS ELDERLY HOUSEHOLDS IN JAPAN

Tadashi Yamada

Tetsuji Yamada

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ABSTRACT

Our study shows that the household production theory illuminates the behavior of households in the allocation of time and consumption expenditures. Among the noteworthy findings derived from our data, the various household non-market time allocations (consequently, market labor supply) cannot be separated from consumption expenditures. An increase in market wage rates for both young and elderly households reduces their time spent on household non-market activities, such as child care, medical care, and listening to the radio and watching TV. The high opportunity costs of waiting at the hospital clearly discourage working people from visiting the hospital. These results show not a few similarities between the household non-market time allocation in Japan and that to be found in the U.S.

Tadashi Yamada
University of Tsukuba
Institute of Socio-Economic Planning
Tennodai 1-1-1, Tsukuba-city
Ibaraki-ken, Japan 305
and NBER

Tetsuji Yamada
Rutgers University - Camden
Department of Economics
Camden, NJ 08102
and NBER

I. Introduction

Human time is one of the most scarce resources. For understanding the way this scarce resource is allocated to satisfy competing human desires, we should look at the household's time allocation on labor supply as merely one of various activities in conjunction with household production (Becker 1965).[1]

Allowing for the fact that the traditional consumer demand analysis puts great emphasis on the behavior of household consumption expenditures, some recent empirical studies are successful in bridging the gap between the consumption expenditure studies and the household production studies (Barnett 1979, Kooreman and Kapteyn 1987, and Biddle and Hamermesh 1990). Although these studies provide useful observations about household time allocation,[2] when the various household consumption expenditures are analyzed, the household non-market time activities are dealt with as a single entity, i.e., leisure. On the other hand, when the different non-market time activities are studied, the consumption expenditures are treated as an aggregate commodity.

To be more consistent with theory and consequently to understand household economic activities more deeply than the traditional demand study, household non-market time activities,

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[1] See Juster and Stafford (1991) for an excellent survey of literature on the allocation of time.

[2] The results are: Barnett (1979) rejects the separability between consumer's labor supply and consumption of market goods; Kooreman and Kapteyn (1987) verify variations in the time allocation of household non-market activities in response to changes in the real wage rate; and Biddle and Hamermesh (1990) focus on a major household time allocation, i.e., sleep, and identify wage effects on sleeping and waking non-market time for men and on market and waking non-market time for women.

rather than being aggregated as a single entity of leisure, need to be simultaneously analyzed with household consumption expenditures in a system of demand functions. This approach allows consistency with standard economic hypotheses such as integrability, separability, and homogeneity. With appropriate parameter restrictions in the system, we are able to test for separability in household non-market time activities.[3]

Furthermore, the aforementioned empirical findings on household time allocation should be verified for different cultures. For example, in a country like Japan, people of different ages and different gender seem to have distinct roles in the household and are likely to behave differently in response to changes in available economic incentives.[4] In addition to our concern with international comparisons regarding the household allocation of time, we focus specifically on some of the social issues currently being debated in Japan.

First, the rate of reproduction among young couples has declined sharply in recent years; the total fertility rate, which is the number of live births by a woman during her reproductive period, was 4.40 in 1948, and 1.75 in 1980. The most recent available figure is 1.53 in 1990.[5] How, then, do young Japanese

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[3] The excellent and comprehensive literature on a system of consumer demand functions to review is Brown and Deaton (1972), Diewert (1974, ch.3), Barten (1977, ch.2a), Lau (1977, ch.2b), Deaton and Muellbauer (1983), Deaton (1986), and Blundell (1988).

[4] The labor market in Japan still keeps the traditional employment system although the Equal Employment Opportunity Law went into effect in 1986 (Edwards 1988).

[5] The Current Conditions of Women's Labor, Ministry of Labor, 1991, p. s87: "Fujin Roudou no Jitsujyo" in Japanese.

households use their time after having chosen a smaller family size ever than before? Second, it is often said, somewhat cynically, that people must wait in a "3-hour" queue at the hospital to receive a "3-minute" medical treatment. A long queue at the hospital reflects a high shadow price of receiving medical care. The high opportunity costs of waiting at the hospital will discourage working people from visiting the hospital. We consequently pose the following question. How responsive is hospital visiting time to changing economic incentives?

The organization of the subsequent sections is as follows: we report the evidence from the survey of the allocation of time over the period from 1976 to 1986 in Section II; our analytical framework is presented in Section III; Section IV reports the empirical findings; and finally Section V draws our conclusion of this study.

II. Evidence from the Survey on Allocation of Time

The cross-sectional data for cities with prefectural government on time spent on daily activities by males and females at different age groups in 1976, 1981, and 1986 are to be found in Basic Survey on Social Life, published by the Bureau of Statistics, Office of the Prime Minister of Japan.

Of "Hours and Minutes per Day spent on Activities" in Tables I-(1) and (2), the reported time allocations are weekly averages of time per day. Table I-(1) shows the young households' (males and females aged 25-39) allocation of time spent on work, sleep, child care, medical care, and Radio & TV (listening to the radio and watching TV). The time activities of elderly households (males aged 65 and over, and females aged 60 and over) are listed in Table I-(2).

The reasons for choosing these different age groups for analysis in our study are that the former young age group has two distinct characteristics: the members of this group are in the middle of determining the size of their families; and most of the males in that age group are very likely to be in the labor market. On the other hand, the latter elderly group at the age of 65 years old is likely to be retired from the labor market and to have started receiving social security retirement benefits. Furthermore, the payments for medical care of members of this group at the hospital are mostly covered by the public medical insurance for elderly people.[6] Hence, we consider that these different age groups

[6] To be more specific, elderly people aged 65 through 69, who are confined to bed, and those aged 70 or more are covered by this health care program.

are most likely to behave differently in response to changes in economic opportunities.

Since the figures reported in the Tables are self-explanatory, we mainly discuss the time allocations of males and females aged 25-39 in Table I-(1). The male market daily working hours rose from 7 hours 22 minutes a day in 1976 to 7 hours 49 minutes in 1986.[7] Since these reported figures are weekly averages of 7 days, if Japanese people hypothetically work the same amount of hours for 5 days a week similar to the western standard, their working hours are nearly 10 hours a day on average.[8]

As regards sleeping hours, males "with a job" sleep shorter hours than males "without a job", roughly by 30 minute a day.[9] Such a large difference, however, vanishes in the case of females. Males sleep longer hours a day than females in Japan. As is to be expected in Japan, males, regardless of their attachment to the labor market, spend little time on child care, while females spend a substantial amount of their time on providing this care. Those females "without a job" spend twice as much time or more each day

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[7] The most recent figures on the average monthly working hours per worker in the manufacturing industry in 1990 are 178.2 hours in firms with 30-99 workers; 174.8 hours in those with 100-499 workers; and 177.0 hours in those with 500 workers or more (White Paper on Labor, Ministry of Labor, 1991, p. 287: "Roudou Hakusyo" in Japanese). Note that the average monthly working hours are not age and male specific, but industry specific values. Hence, these average monthly working hours are somewhat different from the male's average daily working hours reported in the text.

[8] 9.6 percent of the firms with 30 or more workers have a regular weekly 2-day off schedule in 1989, which cover 36.9 percent of total employment in industries (The Current Conditions of Women's Labor, Ministry of Labor, 1990, p. s94).

[9] Biddle and Hamermesh (1990) report that "Time spent sleeping is inversely related to both the wage and time spent in the labor market (p. 941)."

on child care than working females, who spend three hours or so on average.[10]

Concerning medical care, males "with a job" have much less time spent on medical care than males "without a job", while this is not so for females.[11] To account for this difference in medical care for males, two testable hypotheses may be offered: the first one, for which we actually make a test in this study, is that males in the labor market face high opportunity costs in visiting the hospital and hence they visit less often as their economic opportunities rise, while the income effects work toward more medical care; and the second one is that males who are not in the labor market are more likely to be ill, and the "not in the labor force" may be an indicator of poor health status. Hence those out of the labor force spend more hours on medical care than those in the market. In this second case, economic opportunities, e.g., their potential market wage rates, will exert little influence on their choice of visiting the hospital. Finally, both males and females "without a job" do spend much more time on Radio & TV (i.e., listening to the radio and watching TV) than those "with a job". This phenomenon again seems to be indicative of the difference in their economic opportunities. In sum, there exist marked behavioral differences in the allocation of time between young persons "with a job" and those "without a job" and also between males and females of the same age group. These observations

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[10] Since a baby-sitter system is not popular in Japan, working females are likely to be either sending their children to nurseries or living with their parents, who take care of children.

[11] The Basic Survey of Social Life does not include patients in the hospital in the sample.

with respect to young people are almost duplicated for elderly people as reported in Table I-(2). Consequently, we consider it extremely valuable to clarify empirically to what extent their time allocations are responsive to changes in their economic opportunities, and to identify their behavioral differences in the allocation of time.

III. Analytical Framework

In a general presentation of the household production theory, consumers in a typical household combine their time inputs with market goods (and services) to produce household non-market commodities, Z_j, $j = 1,\ldots,n$. A vector of the household commodities directly enter the household utility function and the household maximizes the utility subject to its income and time constraints, often named "full income" in the theory. Through this maximization problem we should be able to define a variety of forms for the elasticities of demand for time allocation on various activities as well as those for market goods.[12]

Here, for the purpose of our theoretical presentation in a comparative static analysis, we assume the following simple two non-market commodities model of the household:

$$U(Z_1, Z_2) , \qquad \ldots\ldots (1)$$

where

$$Z_1 = Z_1(X_1, t_{z1}) , \qquad \ldots\ldots (2)$$

and

$$Z_2 = Z_2(X_2, t_{z2}, t_{m2}) , \qquad \ldots\ldots (3)$$

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[12] This general presentation, however, involves ungovernable calculation and is almost intractable, though not impossible. For example, even in a very simple model such as only two household non-market commodities in the utility function, i.e., $U = U(Z_1, Z_2)$, where $Z_j = Z_j(x_j, t_j)$ for $j = 1$ and 2, it seems a little bit complicated that the elasticity of labor supply with respect to wage rate is the proportion of total time spent at non-market activities minus a weighted average of three elasticities of substitution: the elasticity of substitution between Z_1 and Z_2 and those between the inputs in each Z_1 and Z_2 (Deardorff and Stafford 1976, p. 679).

where U is utility function of the female, f, and male, m, members of an average household; X_j (j = 1, 2) is a vector of market good inputs; and t_{ij} is the time input spent by person i (i = f, m) on production of Z_j. In our specification, the male specializes in production of Z_2, but it certainly does not matter whether the male or the female in the household specializes in production of Z_2. Simply, we assume that there is a household non-market commodity which requires only the time allocation of either one. Finally, we assume that $U_j = \partial U/\partial Z_j > 0$; $U_{kj} = \partial U_j/\partial Z_k > 0$ if $j \neq k$; and $U_{jj} = \partial U_j/\partial Z_j < 0$.

For the household non-market commodities, the following fixed-proportions production functions with inputs are assumed:

$$X_1 = a\,Z_1\ ;\quad X_2 = b\,Z_2\ ;\ t_{f1} = \alpha\,Z_1\ ;\ \text{and}\quad t_{f2} + t_{m2} = \beta\,Z_2\ , \qquad \ldots\ldots\ (4)$$

where a, b, α, and β are positive coefficients.

The household maximizes the utility subject to its full income, F, defined as:

$$\sum_{j=1}^{n} P_jX_j + w_mT_m + w_fT_f = w_mT + w_fT + V = F\ , \qquad \ldots\ldots\ (5)$$

where P_j is a vector of the unit prices of market goods in Z_j; w_i is the earnings per unit of time for person i; T_i is a vector of total time inputs spent by person i at the household non-market activities, e.g., $T_f = \sum_{j=1}^{n} t_{fj}$, n=2; T is the total number of hours available such as 24 hours a day;[13] and V is non-labor household

[13] Hence, $T_{iw} = T - T_i$ is the amount of time spent by person i in the labor market.

income.

The above maximization problem provides the following qualitative signs of $\partial \ln t_{ij}/\partial \ln w_i$, $(i = f,m;$ and $j = 1,2)$:

$$\partial t_{f1}/\partial w_f = -(t_{f1} + t_{f2})\ \partial t_{f1}/\partial F + \lambda(\pi_2^m - \pi_2^f)[-(\pi_2^m - \pi_2^f)U_{22*} + (\pi_2^m U_{12*} - \pi_{1f})U_{22*}]D^{-1} < 0;$$

and similarly,

$\partial t_{f1}/\partial w_m > 0$; $\partial t_{f2}/\partial w_f = ?$; $\partial t_{f2}/\partial w_m > 0$; $\partial t_{m2}/\partial w_f = ?$; and $\partial t_{m2}/\partial w_m < 0$, ... (6)

where $\partial t_{f1}/\partial F$ is the full-income effect on t_{f1}; λ is the marginal utility of full income; π_j^i is the i-th person's shadow price of Z_j; $U_{12*} = U_{12}/\alpha\beta$; $U_{22*} = U_{22}/\beta^2$; and D is the determinant of the bordered Hessian, defined as:

$$D = \begin{vmatrix} 0 & -\pi_1^f & -\pi_2^f & -\pi_2^m \\ -\pi_1^f & U_{11*} & U_{12*} & U_{12*} \\ -\pi_2^f & U_{21*} & U_{22*} & U_{22*} \\ -\pi_2^m & U_{21*} & U_{22*} & U_{22*} \end{vmatrix} < 0, \qquad ..... (7)$$

where $\pi_1^f = [(aP_1/\alpha) + w_f]$; $\pi_2^i = [(bP_2/\beta) + w_i]$, $(i = f, m)$; $U_{11*} = U_{11}/\alpha^2$; $U_{12*} = U_{21*}$; and we assume that $U_{12*}U_{21*} - U_{11*}U_{22*} < 0$, (i.e., $U_{12}^2 - U_{11}U_{22} < 0$), for $D < 0$.

From the above comparative static analysis, as female market wage rate rises, the female, only whose time input with market goods is required for the production of Z_1, spends less her time on Z_1, but spends more as male market wage rate rises. On the other hand, when the time of the female and that of the male are perfect

substitutes such as $t_{f2} + t_{m2} = \beta Z_2$, the qualitative signs of female wage effects on the female and male time spent on Z_2 are ambiguous. In terms of their labor supply to the market, the male wage effect on the female labor supply is negative, while it is positive for the male labor supply.[14]

To make the above household production model empirically operational, we take an approach of the household cost function in Deaton and Muellbauer (1980) and estimate a system of demand functions, in which a typical i-th cost share function is defined as follows:

$$S_i = a_i + \sum_j r_{ij} \log p_j + b_i \log y , \quad \ldots\ldots (8)$$

where $S_i = p_i x_i / (\sum_{j=1}^{n} P_j X_j + w_m T_m + w_f T_f)$, in which p_i is the unit price of market good x_i,[15] and $y = (\sum_{j=1}^{n} P_j X_j + w_m T_m + w_f T_f) / CPI$, in which CPI is the consumer price index.

The parameter restrictions in equation (8) are $\sum_i a_i = 1$, $\sum_i r_{ij} = \sum_j r_{ij} = \sum_i b_i = 0$ (the linearly homogenous condition) and $r_{ij} = r_{ji}$ (the Slutsky symmetry condition). We apply this econometric model to the data on time allocations and consumption expenditures of young and elderly households in Japan.

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[14] The wage effect on the male (or female) labor supply to the market is obtained as follows: $\partial T_{iw}/\partial w_i = \partial T/\partial w_i - \partial T_i/\partial w_i$; and in the case of female labor supply, we have $\partial T_{fw}/\partial w_f = \partial T/\partial w_f - \partial T_f/\partial w_f = -(\partial t_{f1}/\partial w_f + \partial t_{f2}/\partial w_f)$.

[15] For example, as one of the S_i is concerned, the time cost share spent by the female on a particular household non-market activity, i.e., t_{fj}, is defined as $S_j = w_f t_{fj} / (\sum_{j=1}^{n} P_j X_j + w_m T_m + w_f T_f)$.

IV. Empirical Findings

In the estimation of our system of demand functions, we use pooled time series data for cities with prefectural government in 1976, 1981, and 1986 on the allocation of time for young males and females both aged 25-39 as well as for elderly males aged 65 or more and those females aged 60 or more.[16] We focus on their time allocations on sleep, child care, medical care, radio & TV, and all other non-market time activities. These time data are collected from the Basic Survey on Social Life. In the system, we also include five categories of household market goods and services consumption: food, housing, clothing, medical care, and all others.[17] Among the total fifteen demand functions in the system, we delete the equation of the household consumption expenditure on "All Others" to avoid the singularity in the estimation.[18]

First, in order to clarify whether the young (and elderly) households behave or not as the traditional consumer demand approach assumes such that the household consumption expenditures are separable in their time allocations, we test for separability in the household non-market time activities (Blackorby, Primont, and Russell 1977). We estimate the parameters of the system of

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[16] Each year has 47 prefectural observations.

[17] Strictly speaking, in grouping numerous household goods and services consumptions into different but appropriate categories, we have to verify whether separability condition is met or not for each item. This is, however, beyond our scope in the present study. Therefore, we follow the conventional classifications in Annual Report on the Family Income and Expenditure Survey by Statistics Bureau, Management and Coordination Agency in Japan.

[18] Each share equation in the system has two yearly dummies and seven regional dummies in addition to a vector of the price variables including the wage rates of males and females and income variables.

unconstrained demand functions and those of the system subject to the separability restrictions. From the chi-square distribution with 58 degrees of freedom, i.e., χ^2 (d.f.=58), we cannot accept the separability restrictions at the significance level $\alpha = 0.01$, as reported in Table II.[19] Therefore, we consider that household decisions on time allocation is jointly determined with household decisions on consumption expenditures. To put it differently, the household labor supply is not the result of a simple labor-leisure choice, but the result of time activities in conjunction with household production. Hence, we support the findings of Barnett (1979) with our own Japanese data.

Tables III-(1) and (2) report the estimates of the wage and income elasticities of the time activities for the young households.[20] In order to have a general view of the wage and income effects on their time activities, we begin with the estimates of "All Households" of young males and females, as shown under (A) in Table III-(1).[21]

With respect to the male wage effect, W_{male}, on his time allocations, as his market wage rate rises, a typical Japanese working male aged between 25 and 39 years old tends to increase his hours spent sleeping (i.e., "Sleep" in Table) and working in the

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[19] For data on "Both (male and female) in the Labor Market" in Table II, we use the data of working males of a given age group with those of working females of the same age group as a working couple. Similarly, we use data for those of "Only Male in the Labor Market" and "Neither in the Labor Market."

[20] See Binswanger (1974) for the calculations of the elasticities and standard errors.

[21] Here, for the purpose of our present study we report only the empirical results of the household allocation of time. Those on the consumption expenditures are available on request.

labor market (i.e., "Labor Supply" in Table) but to reduce his hours spent on the other household non-market activities including "Medical Care".[22] The male wage effects on female time activities are positive regarding the hours of her sleeping and listening to the radio and watching TV (i.e., "Radio & TV" in Table) but negative regarding all her other time activities including her labor supply.[23] As regards the effects of W_{female}, as the wage rate rises, the male enjoys more hours of sleeping, medical care, and listening to the radio and watching TV, while the female works more in the labor market. Another point concerning young households is that wage effects on "Child Care" for both males and females are negative, so we can conclude that they tend to choose to have less number of children as their market opportunities improve. With respect to income effects, as the household income rises, the young households spend more hours on household non-market time activities, i.e., producing more household non-market commodities, but reduces their hours of work in the market.

Now we will highlight and discuss in a little more detail the important results concerning young working households, as reported in Tables III-(1) and (2).[24] As regards "Both in the Labor Market" under (B) in Table III-(1), the male (or female) wage effect on his

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[22] Although not reported in Table III-(1), the estimate of wage elasticity of "male's all other non-market time activities" is negative, -0.746.

[23] The wage elasticity on "female's all other non-market time activities" is -0.188.

[24] Since there are only a few qualitative differences in the empirical results between "Both in the Labor Market" as reported under (B) in Table III-(1) and "Only Male in the Labor Market" under (C) in Table III-(2), we focus only on those results of the former.

(or her) sleeping is positive and statistically significant in contrast to the U.S. experience, where the effects are negative (Biddle and Hamermesh 1990).[25] The positive estimates for Japanese working males and females are, however, not a puzzling result. Since our data on time allocation are weekly averages of time per day, a working couple may make up for a lack of weekdays' sleeping hours by sleeping more over the weekend.[26]

Also, as the market wage rates increase, both males and females increase their working hours: the estimated labor supply elasticity for males is 0.369; and that for females is 0.631.[27] These values are comparable with those reported by the previous studies (Shimada and Higuchi 1985 and Yamada, et al. 1987). The cross wage effects are negative for both males and females. That is, a rise in the partner's market wage encourages his (or her) withdrawal from the labor market. The estimated own wage and income elasticities of female labor supply are nearly twice as large as

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[25] The estimated own wage elasticity of sleeping for males is 0.153, while the value is 0.147 for females: a ten-percent rise in male wage rate increases his average sleeping time by about 7 minutes a day [10 x 0.00153 x 463 minutes (see, in Table I-(1), that a typical male aged 25-39 "With a Job" sleeps 7:43, i.e., 463 minutes a day, in 1986)].

[26] In Japanese cartoons, it is very common to have a character of a prime age working male who has no energy left with himself on a weekend due to his excessive work during weekdays, e.g., daily overtime work till nearly midnight. He in the cartoon loves sleeping at home on the weekend, although his wife and children are expecting that he would take his family out such as a driving, shopping, and so forth. They always wait a long time! This cynicism is not totally false.

[27] These labor supply elasticities are not directly obtained from the estimated coefficients in the system of demand functions, since the share equations of male and female labor supply are excluded from the system by theory. The elasticities are simply a weighted average of the own wage elasticities of non-market activities.

those for males. This is probably because the female has more alternatives in allocating her time than does her husband, since a married woman in Japan normally specializes in household production and is consequently less attached to the labor market than her spouse.

Increases in hours of sleeping and labor supply for both males and females due to an increase in their market wage rates reduce their household non-market activities such as "Child Care", "Medical Care", and "Radio & TV". These findings are congruent with those drawn in the case of two-earner U.S. households by Kooreman and Kapteyn (1987). With respect to the "Child Care", the higher the opportunity cost to raise children for a typical working young couple the smaller will be the size of family members chosen by the household. Contrary to the negative wage effects on child care, a rise in household income encourages them to spare more time for child care. That is, an increase in household income raises the number of children (and/or maybe the quality of children too) in the household.[28]

With our study of the wage effect on the time allocation on medical care, the result is negative (as is to be expected for both

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[28] The total amount of parents' time, T_c, spent on children in a typical household is t x N, where t is the average time spent on each child by the parents and N is the number of children in the household. Then, $\partial \ln T_c / \partial \ln \text{Income} = \partial \ln t / \partial \ln \text{Income} + \partial \ln N / \partial \ln \text{Income}$. From our empirical result, we know $\partial \ln T_c / \partial \ln \text{Income} > 0$. Therefore, if t is fixed, the number of children rises as the household income increases. On the other hand, if N is fixed, the "quality (given the condition that the parents' time is superior to any other substitutes)" of child will increase as the income rises. In realty, a mixture of the positive income effects seem to be held on both t and N.

working males and females), but statistically insignificant.[29] A one-percent rise in male wage rate reduces his time spent on medical care, e.g., waiting at the hospital, by about 3 percent (i.e., -3.009 for male "Medical Care" under W_{male} and -2.963 for female "Medical Care" under W_{female}). Putting it differently, a typical working male reduces his time spent on hospital visits by about 6 minutes a week in response to a ten-percent increase in his wage rate [7 days a week x 10 x -0.03009 x 3 minutes spent on "Medical Care" by males "With a job" in 1986 in Table I-(1)]. Although the value itself is small, this seems to be indicative of one of the reasons why prime age working males and females are rarely to be found waiting their turns in the busy lobbies of hospitals all day long.

Now we will discuss the empirical results on elderly households, as reported in Tables IV-(1) and (2). About the "All Households" under (A) in Table IV-(1), the W_{male} effect is positive on male "labor supply" and a rise in the wage rate encourages his spouse to take more "Sleep" and "Child Care" of, presumably, their grand-children. But, for the W_{female} effect which is positive on her market labor supply, the male is not so helpful for caring grand-children. In other words, when elderly people are not responsible for taking care of their grand-children, as their market economic opportunities rise, they seem not to retire early from the labor market.

The most striking findings for working elderly males, as shown

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[29] This wage effect on males is negative and statistically significant for the case of "All Households" reported under (A) in Table III-(1).

under (B) in Table IV-(1) and under (C) in Table IV-(2), are that the wage effects on their time spent on "Sleep", "Child Care", "Medical Care", and "Radio & TV" are all negative and statistically significant.[30] The negative wage effect on "Medical Care" and the positive effect on "Labor Supply" for working elderly males clearly indicates that their condition of good health postpones their retirement from the labor market, in sharp contrast to the positive wage effect on "Medical Care" for the "Neither one in the Labor Market" household as reported under (D) in Table IV-(2).[31] As for the W_{female} effects on her household non-market time activities, a general impression is that the negative wage effects dominate, but that they are statistically much weaker in significance than with the male counterparts.

In sum, our empirical findings show that household decisions on the allocation of time is not independent of household decisions on consumption expenditures. An increase in wage rates stimulates the market labor supply for both young and elderly people, but generally reduces their non-market time activities. On the other hand, household income has dominant positive effects on the time allocations on sleeping, child care, medical care, and listening to the radio and watching TV.

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[30] These qualitative results are similar to those for working young males except for the effect on "Sleep", but the statistical results for working young males are much weaker than those with working elderly males.

[31] As often done in the literature of labor economics, A wage equation for non-participants in the labor market should be estimated in an appropriate manner. Since we are not successful in collecting the relevant variables for the equation, we instead use the industry average wage rates for the non-participants. Therefore, our results for them are only suggestive.

V. Conclusions and Implications

In this study, by using the pooled time series data in 1976, 1981, and 1986, we analyze the allocation of time of young (aged 25-39) and elderly (aged 65 or more) households in Japan. We estimate a system of demand functions, in which the equations of household non-market time activities are simultaneously estimated with those of household consumption expenditures.

Among the noteworthy findings derived from our data, first of all, in our test for separability in the household time allocation, we cannot accept the separability restrictions. Hence, as has already been suggested by some U.S. data, our Japanese data show that household non-market time allocations (consequently, its market labor supply) are not separable from consumption expenditures.

Secondly, an increase in the market wage rates for both young and elderly households reduces their time spent on the household non-market activities such as child care, medical care, and listening to the radio and watching TV. We consider one reason why young working couples have smaller families in recent years to be bound up with the improvements in their economic opportunities in the labor market. Since fewer children are born and fewer working people are now supporting currently retired people than in the past, and since these trends will continue in the near future, raising the retirement age recommended by the Japanese government would encourage people to work longer and thus would reduce the ratio of retired to working age people.

Thirdly, as hypothesized, the high opportunity costs of waiting at the hospital clearly discourage working people from

visiting the hospital. Requiring firms to have their own clinics and encouraging hospitals to make appointments for patients would reduce waiting time.

As a concluding remark, our study shows that the household production theory illuminates the behavior of households in the allocation of time and consumption expenditures. The results of our empirical model based on the theory show not a few similarities between the forms of household behavior in different cultures, e.g., the U.S. and Japan.

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TABLE I-(1)

Hours and Minutes per Day spent on Activities

Males Aged 25 - 39

Activities	1976 Persons With a job	1976 Persons Without a job	1981 Persons With a job	1981 Persons Without a job	1986 Persons With a job	1986 Persons Without a job
Work	7:22	0:46	7:31	0:20	7:49	0:13
Sleep	8:09	8:42	7:58	8:25	7:43	8:17
Child Care	0:07	0:28	0:06	0:27	0:10	0:21
Medical Care	0:05	1:32	0:02	1:07	0:03	0:39
Radio & TV	2:12	3:19	1:56	3:15	1:57	4:02

Females Aged 25 - 39

Activities	1976 Persons With a job	1976 Persons Without a job	1981 Persons With a job	1981 Persons Without a job	1986 Persons With a job	1986 Persons Without a job
Work	6:02	0:24	5:36	0:13	5:24	0:06
Sleep	7:43	7:50	7:33	7:41	7:24	7:28
Child Care	3:07	6:19	3:06	6:26	3:17	7:02
Medical Care	0:06	0:12	0:04	0:07	0:04	0:09
Radio & TV	1:51	2:35	1:36	2:16	1:37	2:11

Note: Values in Table should read in Hours:Minutes, e.g., 7:22 = 7 hours and 22 minutes a day. Medical care implies medical examination and treatment at clinics and hospitals. Child Care includes House Keeping, and Radio & TV includes time spent on reading newspapers and magazines.

Sources: Bureau of Statistics, Office of the Prime Minister in Japan, Basic Survey on Social Life - Whole Japan : Time Spent on Activities, 1976 (pp. 18-23), 1981 (pp. 26-43), and 1986 (pp. 26-43).

TABLE I-(2)

Hours and Minutes per Day spent on Activities

Males Aged 65 and Over

Activities	1976 Persons With a job	1976 Persons Without a job	1981 Persons With a job	1981 Persons Without a job	1986 Persons With a job	1986 Persons Without a job
Work	5:36	0:39	6:50	0:23	5:33	0:12
Sleep	8:50	9:34	8:32	9:34	8:29	9:11
Child Care	0:10	0:23	0:11	0:29	0:15	0:37
Medical Care	0:17	1:18	0:11	0:47	0:11	0:44
Radio & TV	2:54	4:07	2:43	4:22	2:55	4:30

Females Aged 60 and Over

Activities	1976 Persons With a job	1976 Persons Without a job	1981 Persons With a job	1981 Persons Without a job	1986 Persons With a job	1986 Persons Without a job
Work	4:49	0:40	5:13	0:21	4:36	0:10
Sleep	8:26	8:55	8:08	8:56	8:13	8:52
Child Care	2:15	3:09	2:17	2:58	2:19	2:45
Medical Care	0:14	0:39	0:08	0:31	0:14	0:36
Radio & TV	2:31	3:25	2:14	3:32	2:25	3:35

Note: Values in Table should read in Hours:Minutes, e.g., 5:36 = 5 hours and 36 minutes a day. Medical care implies medical examination and treatment at clinics and hospitals. Child Care includes House Keeping, and Radio & TV includes time spent on reading newspapers and magazines.

Sources: Bureau of Statistics, Office of the Prime Minister in Japan, Basic Survey on Social Life - Whole Japan : Time Spent on Activities, 1976 (pp. 18-23), 1981 (pp. 26-43), and 1986 (pp. 26-43).

TABLE II

Test for Separability in the Household Time Allocation

A Household of Male and Female aged 25-39

	Log of Likelihood Function		Log likelihood Ratio
	Unconstrained A	Constrained B	2(A-B)
All Households	9467.58	9418.93	97.30[a]
Both in the Labor Market	9564.35	9502.46	123.78[a]
Only Male in the Labor Market	9673.96	9613.69	120.54[a]

A Household of Male aged 65 and over and Female aged 60 and over

	Log of Likelihood Function		Log likelihood Ratio
	Unconstrained A	Constrained B	2(A-B)
All Households	8358.94	8282.50	152.88[a]
Both in the Labor Market	7806.50	7730.90	151.20[a]
Only Male in the Labor Market	8175.28	8103.18	144.20[a]
Neither one in the Labor Market	8203.73	8130.40	146.66[a]

a: significant at the 1% level.

Note: The degrees of freedom are $\chi^2(58)$.

TABLE III-(1)

Estimates of Wage and Income Elasticities of the Allocation of Time

A Household of Male and Female aged 25-39

All Households

Allocation of time	With Respect to Wmale	Wfemale	Income	Allocation of time	With Respect to Wmale	Wfemale	Income
Male				**Female**			
Sleep	0.172[a]	0.353[a]	0.002	Sleep	0.073	0.135	0.220
	(0.040)	(0.029)	(0.059)		(0.159)	(0.116)	(0.234)
Child Care	-1.314	-2.081[b]	3.742[b]	Child Care	-0.003	-1.080[a]	2.015[a]
	(1.146)	(0.838)	(1.686)		(0.246)	(0.179)	(0.361)
Medical Care	-4.471[c]	0.872	2.787	Medical Care	-7.041[a]	-1.154	7.780[a]
	(2.649)	(1.937)	(3.898)		(1.886)	(1.379)	(2.775)
Radio & TV	-0.038	0.196	0.406	Radio & TV	0.182	-0.557[b]	1.136[a]
	(0.251)	(0.184)	(0.369)		(0.298)	(0.218)	(0.439)
Labor Supply	0.509[a]	-0.244[a]	-1.602[a]	Labor Supply	-0.266	1.991[a]	-6.393[a]
	(0.010)	(0.005)	(0.021)		(0.260)	(0.139)	(0.564)

a: significant at the 1% level.
b: significant at the 5% level.
c: significant at the 10% level.

Note: The own wage elasticity is defined as $\epsilon_{i,i} = (r_{ii}/s_i)+s_i-1$; the cross wage elasticity is as $\epsilon_{i,j} = (r_{ij}/s_i)+s_j$; and income elasticity is as $\eta_{i,income} = (b_{i,income}/s_i)+1$. All the elasticities are evaluated at the sample means. S_i is the total expenditure share of i-th input. The standard errors are in parentheses.

TABLE III-(2)

Estimates of Wage and Income Elasticities of the Allocation of Time

A Household of Male and Female aged 25-39

Both in the Labor Market

Allocation of time	With Respect to Wmale	Wfemale	Income	Allocation of time	With Respect to Wmale	Wfemale	Income
Male				**Female**			
Sleep	0.153[a]	0.293[a]	0.070	Sleep	0.137[b]	0.147[a]	0.002
	(0.039)	(0.028)	(0.058)		(0.056)	(0.040)	(0.083)
Child Care	-1.362	-2.008[a]	3.684[b]	Child Care	-0.277	-1.217[a]	1.992[a]
	(1.080)	(0.772)	(1.603)		(0.323)	(0.231)	(0.479)
Medical Care	-3.009	-0.709	2.218	Medical Care	-7.417[b]	-2.963	10.165[b]
	(2.554)	(1.827)	(3.792)		(3.109)	(2.224)	(4.615)
Radio & TV	-0.030	0.267	0.277	Radio & TV	0.174	-0.330	0.973[b]
	(0.249)	(0.178)	(0.370)		(0.319)	(0.228)	(0.474)
Labor Supply	0.369[a]	-0.218[a]	-1.467[a]	Labor Supply	-0.039	0.631[a]	-2.606[a]
	(0.009)	(0.004)	(0.019)		(0.042)	(0.021)	(0.092)

a: significant at the 1% level.
b: significant at the 5% level.
c: significant at the 10% level.

Note: The own wage elasticity is defined as $\epsilon_{i,i} = (r_{ii}/s_i)+s_i-1$; the cross wage elasticity is as $\epsilon_{i,j} = (r_{ij}/s_i)+s_j$; and income elasticity is as $\eta_{i,income} = (b_{i,income}/s_i)+1$. All the elasticities are evaluated at the sample means. S_i is the total expenditure share of i-th input. The standard errors are in parentheses.

TABLE III-(3)

Estimates of Wage and Income Elasticities of the Allocation of Time

A Household of Male and Female aged 25-39

Only Male in the Labor Market

Allocation of time	With Respect to Wmale	Wfemale	Income	Allocation of time	With Respect to Wmale	Wfemale	Income
Male				**Female**			
Sleep	0.154[a] (0.043)	0.363[a] (0.038)	0.032 (0.078)	Sleep	0.105 (0.067)	0.161[a] (0.059)	0.027 (0.121)
Child Care	-2.052[c] (1.170)	-3.074[a] (1.028)	5.751[a] (2.108)	Child Care	0.458[c] (0.256)	-0.332 (0.225)	0.495 (0.461)
Medical Care	-2.833 (2.797)	-0.881 (2.458)	2.300 (5.039)	Medical Care	-5.925[b] (2.403)	-0.348 (2.112)	5.626 (4.329)
Radio & TV	-0.176 (0.271)	0.109 (0.238)	0.742 (0.488)	Radio & TV	0.964[a] (0.363)	0.347 (0.319)	-1.006 (0.654)
Labor Supply	0.497[a] (0.011)	-0.053[a] (0.008)	-1.910[a] (0.034)				

a: significant at the 1% level.
b: significant at the 5% level.
c: significant at the 10% level.

Note: The own wage elasticity is defined as $\epsilon_{i,i} = (r_{ii}/s_i)+s_i-1$; the cross wage elasticity is as $\epsilon_{i,j} = (r_{ij}/s_i)+s_j$; and income elasticity is as $\eta_{i,income} = (b_{i,income}/s_i)+1$. All the elasticities are evaluated at the sample means. S_i is the total expenditure share of i-th input. The standard errors are in parentheses.

TABLE IV-(1)

Estimates of Wage and Income Elasticities of the Allocation of Time

A Household of Male aged 65 and over and Female aged 60 and over

All Households

Allocation of time	With Respect to Wmale	Wfemale	Income	Allocation of time	With Respect to Wmale	Wfemale	Income
Male				**Female**			
Sleep	-0.187[a] (0.050)	0.166[a] (0.053)	0.697[a] (0.091)	Sleep	0.199[a] (0.036)	-0.005 (0.038)	0.473[a] (0.065)
Child Care	-1.502[a] (0.520)	-0.262 (0.544)	1.883[b] (0.936)	Child Care	0.227 (0.153)	-0.130 (0.160)	0.367 (0.276)
Medical Care	-0.203 (0.767)	-0.357 (0.803)	1.431 (1.382)	Medical Care	-0.553 (0.523)	-0.596 (0.547)	2.230[b] (0.941)
Radio & TV	-0.448[a] (0.142)	-0.023 (0.148)	1.101[a] (0.255)	Radio & TV	-0.045 (0.114)	-0.296[b] (0.119)	0.968[a] (0.205)
Labor Supply	1.923[a] (0.057)	-0.587[a] (0.044)	-6.067[a] (0.184)	Labor Supply	-2.424[a] (0.159)	0.930[a] (0.174)	-8.441[a] (0.517)

a: significant at the 1% level.
b: significant at the 5% level.
c: significant at the 10% level.

Note: The own wage elasticity is defined as $\epsilon_{i,i} = (r_{ii}/s_i)+s_i-1$; the cross wage elasticity is as $\epsilon_{i,j} = (r_{ij}/s_i)+s_j$; and income elasticity is as $\eta_{i,income} = (b_{i,income}/s_i)+1$. All the elasticities are evaluated at the sample means. S_i is the total expenditure share of i-th input. The standard errors are in parentheses.

TABLE IV-(2)

Estimates of Wage and Income Elasticities of the Allocation of Time

A Household of Male aged 65 and over and Female aged 60 and over

Both in the Labor Market

Allocation of time	With Respect to Wmale	Wfemale	Income	Allocation of time	With Respect to Wmale	Wfemale	Income
Male				**Female**			
Sleep	-0.151[a]	0.204[a]	0.616[a]	Sleep	0.238[a]	0.085[b]	0.376[a]
	(0.047)	(0.049)	(0.084)		(0.041)	(0.043)	(0.074)
Child Care	-1.934[b]	-0.767	2.629[c]	Child Care	-0.066	-0.532[b]	1.001[a]
	(0.826)	(0.864)	(1.489)		(0.201)	(0.210)	(0.362)
Medical Care	-1.883[c]	-1.491	3.359[c]	Medical Care	-1.714	0.995	-0.836
	(1.089)	(1.139)	(1.963)		(1.660)	(1.736)	(2.993)
Radio & TV	-0.507[a]	0.074	0.814[a]	Radio & TV	-0.381[b]	-0.717[a]	1.612[a]
	(0.139)	(0.146)	(0.251)		(0.177)	(0.185)	(0.319)
Labor Supply	0.863[a]	-0.259[a]	-2.623[a]	Labor Supply	-0.240[a]	0.516[a]	-2.816[a]
	(0.011)	(0.012)	(0.034)		(0.024)	(0.026)	(0.078)

a: significant at the 1% level.
b: significant at the 5% level.
c: significant at the 10% level.

Note: The own wage elasticity is defined as $\varepsilon_{i,i} = (r_{ii}/s_i)+s_i-1$; the cross wage elasticity is as $\varepsilon_{i,j} = (r_{ij}/s_i)+s_j$; and income elasticity is as $\eta_{i,income} = (b_{i,income}/s_i)+1$. All the elasticities are evaluated at the sample means. S_i is the total expenditure share of i-th input. The standard errors are in parentheses.

TABLE IV-(3)

Estimates of Wage and Income Elasticities of the Allocation of Time

A Household of Male aged 65 and over and Female aged 60 and over

Only Male in the Labor Market

Allocation of time	With Respect to Wmale	Wfemale	Income	Allocation of time	With Respect to Wmale	Wfemale	Income
Male				**Female**			
Sleep	-0.259[a] (0.048)	0.097 (0.060)	0.874[a] (0.097)	Sleep	0.257[a] (0.043)	0.057 (0.053)	0.291[a] (0.086)
Child Care	-1.990[b] (0.873)	-1.001 (1.087)	2.952[c] (1.764)	Child Care	0.301[b] (0.152)	-0.015 (0.190)	0.173 (0.308)
Medical Care	-1.960[c] (1.154)	-1.835 (1.437)	3.805 (2.333)	Medical Care	-0.614 (0.475)	-0.970 (0.591)	2.787[a] (0.960)
Radio & TV	-0.698[a] (0.144)	-0.188 (0.179)	1.316[a] (0.290)	Radio & TV	0.140 (0.104)	-0.069 (0.129)	0.580[a] (0.210)
Labor Supply	1.221[a] (0.011)	0.162[a] (0.018)	-3.582[a] (0.047)				

a: significant at the 1% level.
b: significant at the 5% level.
c: significant at the 10% level.

Note: The own wage elasticity is defined as $\epsilon_{i,i} = (r_{ii}/s_i)+s_i-1$; the cross wage elasticity is as $\epsilon_{i,j} = (r_{ij}/s_i)+s_j$; and income elasticity is as $\eta_{i.income} = (b_{i.income}/s_i)+1$. All the elasticities are evaluated at the sample means. S_i is the total expenditure share of i-th input. The standard errors are in parentheses.

TABLE IV-(4)

Estimates of Wage and Income Elasticities of the Allocation of Time

A Household of Male aged 65 and over and Female aged 60 and over

Neither one in the Labor Market

Allocation of time	With Respect to Wmale	Wfemale	Income	Allocation of time	With Respect to Wmale	Wfemale	Income
Male				**Female**			
Sleep	-0.221[a]	0.161[b]	0.713[a]	Sleep	0.158[a]	-0.072	0.573[a]
	(0.077)	(0.081)	(0.143)		(0.058)	(0.061)	(0.108)
Child Care	-1.664[b]	-0.322	1.972	Child Care	0.325	-0.005	0.205
	(0.687)	(0.726)	(1.286)		(0.205)	(0.217)	(0.384)
Medical Care	0.299	0.389	0.021	Medical Care	-1.459[b]	-1.515[b]	4.210[a]
	(0.925)	(0.977)	(1.733)		(0.636)	(0.672)	(1.191)
Radio & TV	-0.033	0.398[c]	0.353	Radio & TV	-0.085	-0.281[c]	1.073[a]
	(0.213)	(0.225)	(0.399)		(0.138)	(0.146)	(0.258)

a: significant at the 1% level.
b: significant at the 5% level.
c: significant at the 10% level.

Note: The own wage elasticity is defined as $\varepsilon_{i,i} = (r_{ii}/s_i)+s_i-1$; the cross wage elasticity is as $\varepsilon_{i,j} = (r_{ij}/s_i)+s_j$; and income elasticity is as $\eta_{i,income} = (b_{i,income}/s_i)+1$. All the elasticities are evaluated at the sample means. S_i is the total expenditure share of i-th input. The standard errors are in parentheses.