Time Use Elasticity of Substitution Estimates Conditional on Working Time Available

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Time Use Elasticity of Substitution Estimates Conditional on Working Time Available

Armagan Tuna Aktuna-Gunes*and Okay Gunes‡

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Abstract

We introduce the demand elasticity of available working time into the model of domestic production in order to show that the limits on discretionary times use may alter the estimates of time use elasticity of substitution good. Our elasticity estimation result for food is 0.50 in Turkey for 2007, which ranges from 0.22 to 0.56 in the literature. However, the elasticity of substitution for food rises up to 0.92 when one considers working time available with all consumption groups, suggesting that households may overcome time scarcity and increase working time by reducing time spent in the leisure, transportation, other, and personal care and health categories. This process, in turn, yields good intensive consumption in Turkey. We obtain more robust estimation results by using the opportunity cost of time measurement proposed by Gardes (2016) for Turkish households in 2007. In this work, the Time Use Survey for 2006 is matched with the 2007 Household Budget Survey by using the method proposed by Rubin (1986). The advantage of this matching method is that the partial correlation between interested variables given in time use and budget surveys are other than zero, eliminating the uncertainty in fabricated data.
Keywords: Household production, Time use elasticity of substitution, Rubins' matching statistics, Working Time Available
JEL: C53, D12, D13, J22

1 Introduction

In recent years increasing attention has been paid to production technology in domestic production, as the relationship between the share of time spent and

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monetary expenditure used during final good production. Gronau and Hamermesh (2006) demonstrate that certain commodities such as health and travel are relatively goods intensive to produce, while leisure activities are relatively time intensive. However, this later raises the problem wherein the household production function indicates the relative difficulty of goods-time substitution in producing this commodity. Hamermesh (2008) examines the relationship between eating inputs such as time—food purchasing, preparation, consumption and clean-up, and goods—purchased foods. Hamermesh (2008) concluded that the elasticity of substitution between time and good is quite low (i.e. lower than one) and that the substitution of goods for time is not easily accomplished in eating activities. In other words, increasing the value of time (due to an increase in shadow prices) tends to increase the monetary expenditures relative to time spent on the domestic production of meals. The basic intuition underpinning the idea is that necessary inputs for the production of meals are rather complementary than substitutionary. Chin (2008) found the evidence that the substitution of time intensive for goods-intensive commodities for eating when wages increase. Furthermore, Baral et al.(2011) suggest that the "food production" goods-time elasticity of substitution will be greater than the "eating" elasticity of substitution. Indeed, they found that the "food production" goods-time elasticity of substitution is about 60% greater than the "eating" goods-time elasticity of substitution. The idea was that goods-time elasticity of substitution of "pure production" should be lower than that measured by "production plus consumption". Later, Davis and You (2013) confirm that it is difficult to substitute money for time in home meal production. Canelas et al.(2014) generalized the method proposed by Hamermesh (2008) to estimate the elasticity of substitution for all types of commodities. They pointed out that substitutability exists between inputs of necessity goods, a higher elasticity of substitution for higher educated households, and a higher elasticity on the opportunity cost of time than on the market wage.

However, we believe that some unresolved points still remain in these researches. Hamermesh (2008) use a double logarithmic model specification to measure substitution elasticity of time according to which the core estimation of goods-time elasticity indeed depends on two presuppositions: The shadow price (i.e. market wage rate) exists if and only if the household members knows the technology of combining consumption with corresponding time. Households substitute the time intensive goods with goods intensive ones since an increase in the shadow price of time immediately raises the relative price of time-intensive commodities. Therefore, the shadow price of time is modulated by time scarcity in each household time budget: If labor supply is supposed to be endogenously determined under market conditions, the time scarcity (i.e. for the domestic production) depends totally on the relationship between income and non-labor time. The higher the labor supply and the lower the non-labor time, hence the greater the time scarcity and the shadow price of time (Gronau, 1986). Our first problem deals with the theoretical specification of the model proposed by Hamermesh (2008). It is natural to wonder under which theoretical specification market wage rate be used as a proxy between time use and monetary expenditures. The second problem with this model is that the opportunity cost of time would be different from market wage rate since perfect substitution between working and not-working hours could be impeded by inelastic labor structures which increase the constraints as the adjustment and transition costs between markets for developing countries.

The question we investigate in this paper is which time use activities do households tend to be more inclined to sacrifice in order to increase good intensive consumption? Thus, the aim of the present paper is precisely to answer this question by focusing on two problematic areas. We propose measuring corrected time use elasticity of substitutions for each expenditure group to better identify the nature of existing complementarity and substitution between these inputs. We suppose that time use elasticity of substitution in one activity would also depend on time use scarcity in this and in other activities. To this end we introduce the ratio of relative time scarcity with respect to working hours in households into the model. This ratio measures the demand elasticity of working time available with respect to times use activity for each group. We decided using Rubin's (1986) matching specification in order to match time use data with household budget survey. The reason is that the "concatenation" method proposed by Rubin (1986, 1987) uses partial correlation between variable Y in A and variable Z in B which reveals uncertainty caused by the use of fabricated data.

The datasets concerns: the Time Use Survey in 2006 and the Household Budget Survey for the year 2007 in Turkey. As we are looking at a developing economy, we test our model by using individual shadow wages through an estimation of the opportunity cost model proposed by Gardes (2016). The remainder of the paper proceeds as follows: Section 2 provides a model specification for time use with money and with labor supply in the multiple commodities setting. Descriptions of the Household Budget Survey and Time Use Survey data with statistical matching based on Rubin's (1986) specifications are given in Section 3. Section 4 discusses the limits of the model used in estimation and later presents the results. Section 5 concludes the paper.

2 Theory and model specification

Becker (1965) assumes households as production entities that are capable of combining time with market goods and transforming them into final commodities. These final goods as production are present in the households' direct utility function. Therefore, from a theoretical standpoint, when one aims to integrate time into consumer theory, there are three important aspects that have to be taken into account: first, the role of time in utility functions; second, the need to include a time constraint; and third, the need to recognize the relationship between time allocation and goods consumption.

2.1 *The basic model of time use:*

Becker argues that consumers combine market goods as a commodity with specific time activities to produce final goods. According to Leontief type of linear production technology, the $(n + 1) \times m$ input requirements matrix A is

$$A = \begin{bmatrix} \tau_1 & \cdots & \tau_k \\ x_{11} & \cdots & x_{1m} \\ \vdots & \cdots & \vdots \\ \vdots & \cdots & \vdots \\ x_{n1} & \cdots & x_{nm} \end{bmatrix} \tag{1}$$

$x_{ij} \geq 0$ is the $i = 1, .., n$ commodity required to produce final good $j = 1, .., m$. The amount of time of a person's required to produce one unit of final goods is $\tau_{ij} \geq 0$. The properties of final production are as follows:

- Coefficients are exogenously given constants.
  - Coefficients are independent of the amount of final production.
  - There is a constant return scale since the amounts of inputs and final production amount increase in the same rate.
  - There isn't joint production meaning that inputs cannot simultaneously be used to produce different final production at the same time.

Household's production technology constraint is

$$Z\mathbf{A} = [x, t] \tag{2}$$

Where $Z = \{z_{ij}\}_{i,j=1} \in R_+$ the final production determines the utility *u(Z)*. The budget constraint is given by

$$I + wt_w \geq PX \tag{3}$$

Where I denotes non-wage incomes and t_w is the hours of work. The time constraint is given by

$$T = t_w + \sum_{i=1}^{n} \sum_{j=1}^{m} \tau_{ij} x_{ij} \;\; with \;\; \tau_{ij} = t_{ij}/x_{ij} \tag{4}$$

T and t_{ij} denote the total time and time spent in household production, respectively. Commodity and time allocation decisions respect the following consumer program

$$\begin{array}{l} MaxU = U(Z) \;\; with \;\; Z\mathbf{A} = [x, t] \\ s.t. \\ I + wt_w \geq PX \quad \rightarrow \lambda \\ T = t_w + \sum\limits_{i=1}^{n} \sum\limits_{j=1}^{m} \tau_{ij} x_{ij} \quad \rightarrow \mu \end{array} \tag{5}$$

The first order conditions determine the monetary value of time as $\mu/\lambda = w$, where λ and μ are the Lagrange multipliers that give the marginal utility of money and time. In other terms, the marginal rate of substitution of income for leisure equals the market wage rate.

2.2 *Simple calculation of the opportunity cost of time:*

Soon after the time allocation approach appeared, Johnson (1966) and Oort (1969) demonstrated that the reason behind determining the wage rate as the monetary value of time is mainly due to the fact that Becker's utility function specification does not include working time. The discussion relies on identifying the value of the marginal utility of labor. Becker's consumer optimization in fact respects the following program: $MaxU = u(L, Y)$; where it is implicitly assumed that nonworking time as leisure (l) and income must be substitute and cannot be complements (Evans 1972). Thus, the unique constraint can be obtained as $Y = w(T - l)$. Two first order conditions give:

$$\left.\begin{array}{l} U_L^{'} = \lambda w \\ U_Y^{'} = \lambda \end{array}\right\} \quad MRS_{LY} = \frac{U_l^{'}}{U_Y^{'}} = w \tag{6}$$

Where λ is the Lagrange multiplier giving the marginal utility of money. The marginal rate of substitution of income for leisure equals the wage rate.

The question is two-fold:

1. How to measure the shadow wage as the opportunity cost of not-working time?
2. How should we include labor time in the individual time intensity consumption decision?

2.3 *Definition Individual Shadow Wages:*

The traditional valuation method of time spent in domestic activities is the *market substitution method* which uses the hourly minimum wage in the market. However, one may argue that the opportunity cost of time (as the shadow wage rate) is supposed to be different from the wage rate especially for developing countries such as Turkey. In fact, constaints in labor markets may increase the adjustment and transaction costs which would in turn render labor markets inelastic and increasing unemployment rates. Therefore, using the wage rate or an alternative opportunity cost method (*for instance potential earnings method*), tend to reject the often quoted idea that the method of valuation time by the opportunity cost gives biased results and over-estimates, compared to those results drawn from a valuation by the substitution method since it was mentioned by Murphy (1978), the minor differences between the two methods hardly justify the debate about which valuation method is most appropriate.

In the literature, the most convenient method of measuring opportunity cost of time through Becker's time allocation model is proposed by Gardes(2016).

He supposes a Cobb-Douglas structure both for the utility and the domestic production functions of the final goods z_i. In this method all the parameters is estimated locally (*i.e.* for each household in the dataset), so that this specification just assumes for each household the constancy of the elasticities γ_i of the domestic productions in the utility, and the elasticities α_i and β_i of the two factors in the production functions in a neighborhood of their equilibrium point. The optimization program is (all variables and coefficients (except a_i and b_i) correspond to a household h which index is omitted in the equations):

$$\max_{m_i,t_i} u(Z) = \prod_i a_i z_i^{\gamma_i} \quad with \quad z_i = b_i m_i^{\alpha_i} t_i^{\beta_i} \tag{7}$$

Let m_i be the monetary expenditure ($p_i x_i$); the full income writen[1] constraint:

$$\sum_i (m_i + \omega t_i) = w t_w + \omega (T - t_w) + I \tag{8}$$

Note that $T - t_w = \sum_i t_i = T_d$ define time of demestic production and that both the market wage and the shadow wage (ω) appear in the budget equation[2]: the shadow wage corresponds to the valuation of time in domestic production, and differs from the market wage w whenever there exist some imperfection on the labor market or if the disutility of labor is smaller for domestic production. In order to estimate the opportunity cost for time, the utility function in equation (7) is re-written:

$$u(Z) = \prod_i a_i z_i^{\gamma_i}$$

$$= \prod_i a_i b_i \left[\prod_i m_i^{\frac{\alpha_i \gamma_i}{\sum \alpha_i \gamma_i}} \right]^{\sum \alpha_i \gamma_i} \left[\prod_i t_i^{\frac{\beta_i \gamma_i}{\sum \beta_i \gamma_i}} \right]^{\sum \beta_i \gamma_i} \tag{9}$$

$$\Leftrightarrow \; u(Z) = m'^{\sum \alpha_i \gamma_i} t'^{\sum \beta_i \gamma_i}$$

The weights $(\alpha_i \gamma_i)/(\sum \alpha_i \gamma_i)$ and $(\beta_i \gamma_i)/(\sum \beta_i \gamma_i)$ give the geometric weighted means of the monetary (m') and time inputs (t') on the right hand side of the equation. Deriving the utility over income Y and domestic production time T_d gives the opportunity cost of time:

$$\omega = \frac{\frac{\partial u}{\partial T_d}}{\frac{\partial u}{\partial Y}} = \frac{\frac{\partial u}{\partial t'} \frac{\partial t'}{\partial T_d}}{\frac{\partial u}{\partial m'} \frac{\partial m'}{\partial Y}} \tag{10}$$

[1]The hypothetically definition of full income is the maximum monetary income which could be measured by multiplying all available total time by the market wage rate net of taxes.

[2]Gardes precises that the shadow wage rate is supposed to be constant among all domestic activities. Child care is sometimes considered as more enjoyable than other domestic activities because it is rationed. We thus suppose that there exists no corner optimum in time allocation among domestic activities. The generalization to spesific opportunity cost of time fo each activity is straitforward.

so that

$$\omega = \frac{m' \sum \beta_i \gamma_i}{t' \sum \alpha_i \gamma_i} \frac{\frac{\partial t'}{\partial T_d}}{\frac{\partial m'}{\partial Y}} \tag{11}$$

from which we get

$$\omega = \frac{\sum \beta_i \gamma_i}{\sum \alpha_i \gamma_i} \frac{T_d (E_{t'/T_d})}{Y(E_{m'/Y})} \tag{12}$$

The ratio of the time and income elasticities is $(E_{t'/T_d})/E_{m'/Y})$. All parameters of the utility function would estimated locally by the first order conditions, so that the household's welfare would depends both on the set of parameters $(a,\ \beta,\ \gamma)$ and on its monetary and time expenditures m_i and t_i[3].

2.3.1 Estimation of shadow wages:

Gardes(2016 and 2014) considers the substitutions between time and money resources for the production of any activity and between money expenditures (or equivalently time expenditures) concerning two different activities in order to calculate the parameters of the utility and domestic production functions.

1. First, the substitution between time and money in the domestic production function of activity i generates the first order conditions:

$$\frac{\frac{\partial u}{\partial t_i}}{\frac{\partial u}{\partial m_i}} = \omega \rightarrow \frac{\alpha_i}{\beta_i} = \frac{m_i}{\omega t_i} \tag{13}$$

Which implies

$$\begin{aligned} \alpha_i &= \tfrac{m_i}{\omega t_i + m_i} \\ \beta_i &= \tfrac{\omega t_i}{\omega t_i + m_i} \end{aligned} \tag{14}$$

under the constraint of a constant economy of scale for each production function: $\alpha_i + \beta_i = 1$. We suppose also that all marginal productivities are positive: $\alpha_i, \beta_i, \gamma_i \geq 0$ and we normalize the utility with the constraint $\sum \gamma_i = 1$ (no economy of scale in the utility)

2. Second, if the substitution between times t_i and t_j in the domestic production of two different final goods i and j is different, this substitution implies another condition between the parameters of the domestic production functions and the utility function:

$$\frac{\gamma_i}{\gamma_j} = \frac{\beta_j t_i}{\beta_i t_j} = \frac{\alpha_j m_i}{\alpha_i m_j} \tag{15}$$

[3] The direct utility can be used to estimate welfare calculations, which generalize usual welfare calculations based solely on wages and monetary expenditures (see the discussion by Aguiar and Hurst, 2007 and an application in Canelas et al., 2013).

so that

$$\gamma_i = \gamma_1 \frac{m_i}{m_1}\frac{\alpha_1}{\alpha_i} \quad ; \quad \forall \mathrm{i} \neq 1 \tag{16}$$

In this respect, the estimation of the opportunity cost of time is directly based on those two steps for all activities i, j:

$$m_i\gamma_j = m_j\gamma_i + \omega\gamma_i t_j - \omega\gamma_j t_i \tag{17}$$

This could be estimated as a system of *(n(n-1))/2* independent equations, calibrating γ_j at the average full budget share for one good or *(n-1)(n-2)/2* equations under the homogeneity constraint of the utility function: $\sum\gamma_i = 1$. In this system, the opportunity cost of time is over-identified, as well as all $\gamma_j, j \geq 1$. We can also sum equations (15) over j with $\sum_j \gamma_j = 1$ to obtain *(n-1)* independent equations:

$$m_i = \gamma_i\left(m + \omega T\right) - \omega t_i \tag{18}$$

This system of equations can be estimated for the whole population, which gives a unique estimate of ω for all households. The estimation can also be performed on sub-populations or by a non-parametric local regression, which affords a set of estimates over the population. The resulting estimates of the opportunity cost of time ω and the parameters γ_j of the utility function are then used through equations (14) to calculate α and β for each household. Finally, these estimates of parameters α, β and γ are used to estimate the opportunity cost of time ω_h for each household in the population by equation (12).

2.4 *The household production function*

According to Becker (1965), full income is fixed (as soon as the total disposable time is known) and the wage rate w does not depend on total time available (T): $\sum_{i=1}^{n} p_i x_i + w\sum_{i=1}^{n} t_i \leq wT$. Although the vast majority of household demand models today make this fixed wage assumption, Becker thought this case was "special and unlikely," and did not impose it for most of his analysis (Chiappori and Lewbel, 2015). An arithmetic exercise suffices to show that the full income constraint can also be rewritten as the function of opportunity cost which differs from net market wage rate: $\sum_{i=1}^{n} p_i x_i + \omega\sum_{i=1}^{n} t_i \neq wT + (\omega - w)\sum_{i=1}^{n} t_i$ where the $(\omega - w)\sum_{i=1}^{n} t_i$ measures the effect of $w \neq \omega$ on full income (see Gardes, 2014). Be that as it may, if $w = \omega$, the full income constraint can also be denoted as

$$\sum_{i=1}^{n} p_i x_i + \omega\sum_{i=1}^{n} t_i = wT \tag{19}$$

Where the left hand side of the equation (19) is equal to $wt_w + \omega(T - t_w)$. Further we get

$$\omega T - \omega t_w = wT - wt_w \tag{20}$$

the left hand side of the equation (20) is $\omega \sum_{i=1}^{n} t_i$, and can be rewritten as

$$\omega \sum_{i=1}^{n} t_i = w(T - t_w) \tag{21}$$

the equation (21) yields to

$$\omega \sum_{i=1}^{n} t_i = \sum_{i=1}^{n} t_i \frac{\sum_{i=1}^{n} p_i x_i}{t_w} \tag{22}$$

since w in equation (21) equals to $\sum_{i=1}^{n} p_i x_i / t_w$[4]. By rearranging the equation (22), it can be further specified as

$$\omega = \nu_i \frac{\sum_{i=1}^{n} m_i}{\sum_{i=1}^{n} t_i} \tag{23}$$

where we use $v_i = \frac{\sum_{i=1}^{n} t_i}{t_w}$ for the simplification. Note that equation (23) is identical to the model used by Hamermesh (2008) for food except that we use the opportunity cost ω instead of net wage rates w and that we put v_i in order to measure the effect of rate of activity time per working time on elasticity of substitution between money and time. The intuition is that the scarcity of time use would be different for each group which in turn would determine working time available. By using the general form of the elasticity of substitution (see, Blackorby et al., 2007; Davis and Shumway, 1996; and by Baral et al.,2011), the goods-time elasticity of substitution (σ_i) for each consumption would be measured by

$$\sigma_i = \frac{\partial \ln(\nu_i \frac{\sum_{i=1}^{n} m_i}{\sum_{i=1}^{n} t_i})}{\partial \ln \omega} = \frac{\partial \ln m_i}{\partial \ln \omega} - \frac{\partial \ln \sum_{i=1}^{n} t_i}{\partial \ln \omega} + \frac{\partial \ln \nu_i}{\partial \ln \omega} = \eta_{m_i} - \eta_{t_i} + \eta_{v_i} \tag{24}$$

where $\eta_{m_i}, \eta_{t_i}, \eta_{v_i}$ in equation (24) represent the demand elasticities with respect to the opportunity cost ω for good purchases, total final good time and to the per working time available respectively. Thus, we can intuitively interpret that an elastic η_v would implies high level of substitution between t_i and t_w which yields, *cetaris paribus,* good-intensive consumptions (and vice versa).

[4]Where we suppose that other incomes are supposed to be zero.

3 Micro data, matching statistics and empirical application

We use two household surveys: the Time use survey (TUS) and the Household budget surveys (HBS) from the Turkish Statistical Institute (TURKSTAT). The HBS have been conducted on a total of monthly 720 and annually 8640 sample households in 2007. Three basic groups of variables have been obtained from these surveys: Variables of the socio-economic status of the households such as the status of property of house, living in village or in rural areas, etc; variables related to individuals (age, gender, academic background). Consumption expenditures variables (food and non alcoholic beverages, alcoholic beverages with cigarette and tobacco, clothing, health, transportation, education services, etc.) In the TUS in 2006, approximately 390 households were selected each month giving a total of 5070 households during the whole year. Within these households 11 815 members aged 15 years and over were interviewed and were asked to complete two diaries – one for a weekday and one for a weekend day – by recording all of their daily activities during 24 hours at ten-minute-slots. This survey on Time use in 2006 is matched independently on the Family budget survey realizing monetary and time expenditure data. In this application we do not take into account the possible spatial autocorrelation between regions.

We combine the monetary and time expenditures into a unique consumption activity at the individual level. We proceed with the matching of these surveys by using similar exogenous characteristics in both datasets as age, size of household using OECD equivalence scales, proportion of children in the households, matrimonial situation, home ownership, number of household members, geographical location separately for head of household and wife[5]. More precisely, we estimate 8 types of time use in the TUS which are also compatible with the available data from HBS as follows:

1. Food Time (TUS) - Food Expenditures (HBS)
2. Personal Care and Health Time (TUS) - Personal Care and Health Expenditures (HBS)
3. Housing Time (TUS) - Dwelling Expenditures (HBS)
4. Clothing Time (TUS) – Clothing Expenditures (HBS)
5. Education Time (TUS) - Education Expenditures (HBS)
6. Transport Time (TUS) - Transport Expenditures (HBS)
7. Leisure Time (TUS) - Leisure Expenditures (HBS)
8. Other Time (TUS) - Other Expenditures (HBS)

[5]The selection equation concerns the households which have a positive time use of their activities.

Food Time includes household and family care as the administration of food. Personal Care Time consists of personal care, commercial-managerial-personal services, helping sick or old household person. Housing Time corresponds to household-family care as home care, gardening and pet animal care, replacement of house-constructional work, repairing and administration of the household. Clothing Time consists of washing clothes and ironing. Education Time includes study (education) and childcare. Transport Time consists of travel and unspecified time use. Leisure Time corresponds to voluntary work and meetings, social life and entertainment as social life, entertainment-culture, and resting-holiday, sport activity as physical practice, hunting, fishing etc., sport, hobbies and games as art and hobbies, mass media as reading, TV/Video, radio and music. Other Time includes employment and labor searching times.

3.1 *Matching procedure*

In this paper, we use the Rubin (1986) matching method which takes into account the concatenation between imputed variable in time dataset[6]. Briefly speaking, according to the concatenation methodology proposed by Rubin (1986, 1987), the variable Y in survey A is imputed in survey B and the variable Z in survey B is imputed in survey A. The software used for this matching has been developed by Alpman (2016). The details of the matching procedure as follows:

1. We consider three different kinds of variable set: First group of variables (Y) include above-explained time use categories in TUS. Second group (Z) are the expenditure variables in HBS corresponding to (Y) in TUS. Third are the common variables (X) such as sex, age, marital status, education level, geographic localization, working status, working sector, status of firm in both surveys. The main hypothesis is that the partial correlation between Y and Z given X is supposed to be different than zero and it is denoted $\rho_{Y,Z|X} \neq 0$.

2. Thus, the partial variance of Y and Z given X, respectively $\rho_{Y|X}$ and $\rho_{Z|X}$, can be obtained by linear regressions of Y and Z on X. At first, we begin by a linear regression model where Y and are successively regressed on X: $Y = a_0 + aX + \epsilon$ and $Z = b_0 + bX + \mu$

3. The partial covariance of (Y,Z) given X, denoted $\sigma_{Y,Z|X}$, can be deduced by $\rho_{Y,Z|X}(\rho_{Y|X} * \rho_{Z|X})^{1/2}$.

4. Supposing that θ and ϑ are the column vectors of the regression coefficients of Y on (1,X) and Z on (1,X) respectively, Y and Z values may be generated for the dataset formed by A and B by using these regression coefficients. In this prediction, it is assumed that Y and Z values are conditionally independent for given X. Rubin (1986) applies the sweep matrix operator: sweeping on Y gives the regression coefficients of Z on (1,X,Y)

[6] We thank to A. Alpman for his help in the application of this matching procedure. See a discussion of matching procedure Alpman and Gardes (2016).

while sweeping on Z gives the regression coefficients of Y on (1,X,Z). The new regression coefficients are used to create new predicted Y and Z values for the dataset formed by A and B.

According to Rubin (1986), multiple imputation is required to avoid erroneous conclusions. That is to say, Rubin(1986) suggest to repeat the steps from *ii* to *v* simply due to the fact that the uncertainty exists regarding the arbitrary choice of $\rho_{Y,Z|X} \neq 0$.

3.2 *Time use vs. commodity use in Turkey for 2007*

We believe that the methodology proposed by Gronau and Hamermesh (2006) captures the degree the relative commodity intensity of time use as the ratio between commodity and time spend in domestic production as time use scarcity in domestic production. The Table 1 gives summary of the production technology for Turkey in 2007. In this table the relative goods/time intensity is obtained by dividing the monetary values to the corresponding monthly time spent amounts[7].

Table 1: *Commodity per Time Spent for 2007*

Relatif Comodity Intensity of Time (Monetary Expenditure/Monetary Time Use)	Food	Health & Personal Care	Housing	Clothing	Education	Transport	Leisure	Other
Year: 2007	9,78	0,59	14,13	3,29	0,89	3,14	0,19	0,10
Standard deviation	20,44	4,79	28,51	8,15	11,46	18,61	3,45	0,73

Source: *Authors calculation from 2006 Time Use Survey and 2007 Households Budget Survey conducted by Turkish Statistical Institute*

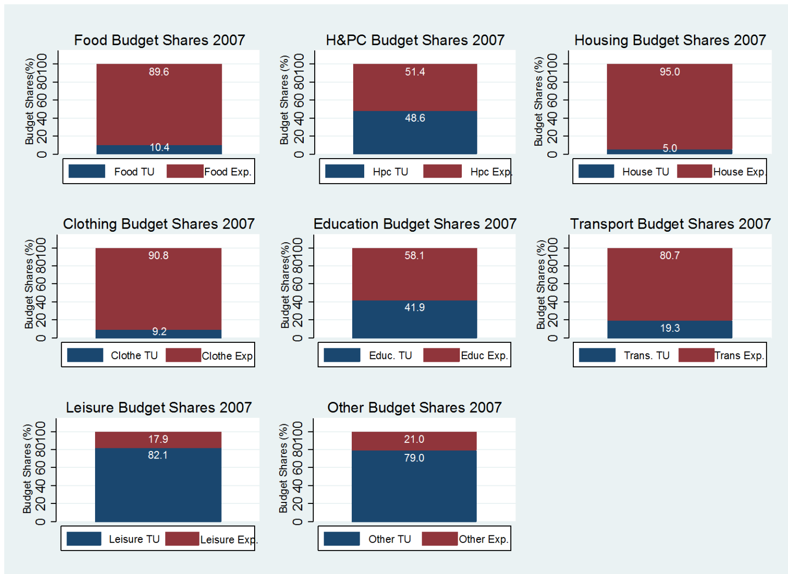
The necessities like housing and food take relatively large shares of total expenditure. By contrast, commodity amount per time spent on transport, clothing, education, health and personal care, leisure and other expenditures takes lower values relative to food.

The full expenditure budget shares for 2007 is given in Graph 1. The average time use shares in full expenditure is 36.93% while monetary expenditures takes 63.06% for 2007. Food[8], housing, clothing and transport take the lowest time use share while leisure, other expenditure, health with personal cares and education have larger time use shares in the households domestic production composition.

[7]Following the methodology proposed by Gronau and Hamermesh (2006), we use the market wage rate to get monetary time use values.

[8]In general, the share of time use shares expected to be higher than 10.4. This is simply due to the fact that the time use in the food category in TUS only includes the time spent for food preparation (washing food, cooking, preparing coffee, tea etc., setting table etc.), dish washing, repealing waste in refrigerator, collecting table etc., doing/drain/ freeze canned, pickle, cheese, bologna, saltwater etc. but not includes shopping and eating time.

Graph 1: *Full Expenditure Budget Shares of Time Use and Monetary Expenditure*



Source: *Authors calculation from 2006 Time Use Survey and 2007 Households Budget Survey conducted by Turkish Statistical Institute*

3.3 *Empirical Application*

3.3.1 The opportunity cost of time:

This method is based on the methodoligical derivation given under the sub-section 2.3. [9]. We apply our method to eight activities, including expenditures on food, personal care with health, housing, clothing, education, transportation, leisure and other expenditures. The estimation of the system of equations (18) is performed on 64 sub-populations defined by age groups, income per unit of consumption, geographic place and family structure. The average estimate of ω_{sp} in 2007 is 4.25 which close to the minimum wage of 2007 rate 3.07 and smaller than the households' average wage rate[10] 4.51. Further, using this estimate to

[9]Note that there is one more method used for measuring shadow wages in the emprical works. Briefly speaking, in this method, the opportunity cost of domestic activities is computed as the average net wage rate for all working individuals in the family, or by their expected hourly wage rate on the labour market for non working individuals. One of the well known estimation procedure is the computationis by the two-step Heckman procedure according to which time is supposed to be perfectly echangeable between the martket and non market household's activities.

[10]The households having hourly wage rate higher than 20 YTL represents only 195 households in the data set with 42.59 YTL of hourly wage in average and having maximum 536.875 YTL. If we use the filter for the households for which having hourly wage rate higher than 20 YTL, the summary statistics for screened data is, N=10804; Mean= 3,832785; Std.

calibrate the opportunity cost in the definition of α_i and β_i (equations 14) and using the estimates of the utility coefficients γ_i by equations (18), gives an average estimate of ω=1.85. These values correspond qualitatively to the answer of individuals in direct surveys on their substitution between time and money, which usually gives an opportunity cost of time much lower than the agent's wage rate net of taxes.The summary of statistics is given in Table 2.

Table 2: *Summary of Wages Statistics*

Variable	Obs.	Mean	Std. Dev.	Min.	Max.
ω_{sp}	24831	4,246	0,962	1,900	11,827
ω	24831	1,852	0,847	0,288	19,571
w	10996	4,516	8,575	0,000	536,875
$\bar{w}$	24831	3,071	0,000	3,071	3,071

3.3.2 Substitution elasticities of time intensive household production:

For our empirical application, similar to Hamermesh's (2008), we assume that good-time intensity would differ depending on the limit of substitution between time use and working time. Thus, two alternative population regression functions is used in order to compare our estimates of elasticity values from (23) from that supposed by Hamermesh(2008) and later by Chin(2008), Baral et al.(2011), Davis and You (2013) and Canelas et al. (2014) as follows.

$$\ln(\frac{m_{i,h}}{t_{i,h}}) = \alpha_0 + \sigma_{\omega_h} \ln(\omega_h) - \sigma_{\nu_{i,h}} \ln(\upsilon_{i,h}) \tag{25}$$

$$\ln(\frac{m_{i,h}}{t_{i,h}}) = \alpha_0 + \sigma_{\omega_h \nu_{i,h}} \ln(\frac{\omega_h}{\nu_{i,h}}) \tag{26}$$

Considering opportunity costs instead of market wage rate facilitates the estimation biases due to consumption group heterogeneity which itself would arise from of the fact that changes in labor supply relative to each time use activity would not be the same. Regression equation (25) measures time use substitution elasticity of commodity use (σ_{ω_h}) for given opportunity cost of households. We suppose that each household may have limited time use resources with which to increase labor supply. Thus, $\sigma_{\nu_{i,h}}$measures the demand elasticity of per working time available, as specified by the theoretical specification in equation (24). Regression equation (26) measures the corrected substitution elasticity of commodity use ($\sigma_{\omega_h \nu_{i,h}}$) as the interaction between opportunity cost and existing scarcity of time use [11] .

Dev.=3,519222 ; Min=0 ; Max=20.

[11]Careful readers may notice that equation (26) indeed estimates the income elasticity of demand using opportunity cost of time use. In actual fact, equation (23) is equal to $\omega t_w = m_i$ where total income is assumed to be equal to ωt_w. Thus the regression equation (26) becomes $\ln(m_{i,h}) = \alpha_0 + \sigma_{\omega_h} \ln(\omega_h t_w)$ which measures the income elasticity of demand.

4 Limitations of the model and estimation results

Whether durable or not, we suppose that non-wage incomes will be allocated to all types of goods and services [12]. This information is assumed to be included in the monetary expenditure in $m_{i,h}$ for each household.

Since Becker 1965 work, much has been published regarding the question of the separability hypothesis in time allocation preferences (see Deaton, 1981, Lecocq, 2001, etc.). The second limitation is that the identification of the separability assumption during time allocation decisions in domestic production is not discussed in this paper [13].

We propose using the Seemingly Unrelated Regression Model (SUREG) to measure the econometric equations in (25) and (26) since an overlap may exist in the unobservable data affected in the regrouped time activities and expenditures in the eight equations for individuals. The results of the estimation of equations (25) and (26) are given in Table 3[14]:

Table 3: *Substitution Elasticity Results of the Estimation of Equations (25) and (26)*

	$\sigma_{\nu_{i,h}}$ (eq.25)	σ_{ω_h}(eq.25)	$\sigma_{\omega_h,\nu_{i,h}}$(eq.26)
Food	-0.921***	0.502***	0.925***
Personal care with health	-1.306***	0.834***	1.180***
Housing	-0.995***	0.963***	0.995***
Clothing	-0.834***	0.892***	0.813***
Education	-0.967***	1.208***	0.973***
Transportation	-1.375***	1.303***	1.458***
Leisure	-1.751***	0.123	1.147***
Other	-1.715***	0.482*	1.372***
Mean	**-1.233**	**0.79< 1**	**1.11> 1**

(*) $p<0.05$, (**) $p<0.01$, (***) $p<0.001$

Overall, the estimated elasticities of substitution (σ_{ω_h}) are positive and significant, with the exception of the leisure group. Necessity goods such as food and housing with clothing, other and health with personal care, have low elasticity of substitution values. The estimate for food 0.502 is similar to those estimated by Hamermesh (2008), Chin (2008), Baral et al. (2011) and Canelas

[12] More recently, Fortin (2009) and Armagan et al.(2014) have shown that non-durable goods (such as food) may also be considered luxury goods in some households.

[13] This information is in fact taken into consideration in equations (15) and (16). The main reason for which being that the model specification in this paper is not based on any sort of demand system such as defined by the theory. Rather, the assumptions of conventional demand analysis necessitate suppressing the role of labor supply decisions in the demand model.

[14] The estimation is made for 2007 and the Breusch-Pagan test of independence for contemporaneous cross-equation error correlation is valid where the p-value for the test based on the chi square distribution is significant (chi2(21) = 2770.298, Pr = 0.0000); hence the null hypothesis of no correlation between error terms is rejected. Table 2 and Table 3 in the appendix shows the results of these estimates.

et al. (2014), ranging from 0.22 to 0.56. Thus, the elasticity of substitution between time and commodity having values less than one, confirms the existence of complementarity in Turkey for 2007. Inputs of necessity goods are fairly complementary since a minimum amount of money and personal time are necessary to produce them and one input cannot be substituted for the other. On the other hand, some substitution exists between time and money for activities such as education and transport. For example, one can decide to walk rather than taking transportation or to choose to have courses in order to cover their learning needs rather than work alone, one easily moves from a money intensive activity to a time intensive (or *vice versa*). Generally speaking, monetary constraints seem to be the largest burden for most households, since substitution between time and money for the necessity and money intensive goods is smaller.

The model in (25) is well estimated with all parameters of the demand elasticity of per working time available ($\sigma_{\nu_{i,h}}$) being significant. Consistent with the substitution elasticity results, necessity goods such as food, housing and clothing have inelastic values implying that households have less discretionary times use in these activities. That is to say, an increase in working time would not increase as much as commodity intensive consumption since time use for these activity groups is already scarce. The intuition is that the amount of money allocated to buy these groups of consumption goods, to a given level, cannot be replaced by time. That is, we all need time to eat, to spend time at home or wear clothes and we cannot pay someone else to do those activities for us. Furthermore, the possibility of substituting time use activities to increase working time is limited, except for transport and leisure groups which have relatively more elastic demand values as -1.375 and -1.751 respectively. For example, households that are more inclined to work have a tendency of taking short, luxury-intensive vacations rather than taking time intensive, long vacations. People may also prefer comfortable and fast (i.e. luxury) transportation over other forms. Generally speaking, the estimation values with $\sigma_{\nu_{i,h}} < -1$ can be interpreted as showing that individual time use values for personal care and health, transportation, leisure and other activities are more substitutable with labor supply. The idea underpinning this result is that these groups are more time abundant, while housing, food, clothing and education are time scarce.

Finally, the last column seen below contains corrected demand elasticities ($\sigma_{\omega_h,\nu_{i,h}}$) which is estimated from equation (26). All estimated elasticities of substitution are significant and R^2 values imply that the model fits better than the model given in equation (25). The corrected elasticities converge to 1, where two necessities, food and housing, are still complementary in nature. That is to say food, housing, clothing and education are time intensive. On the other hand, people are ready to increase commodity intensive consumption for personal care with health, transportation, leisure and other expenditure groups. The mean values in the last line give an overview of the time intensive nature of substitution elasticities for Turkey in 2007. The mean value of substitution elasticity obtained from equation (25) shows an important complementary consumption pattern (0.79<1) for Turkey while it became substitutable (1.11>1) due to the fact that households are more inclined to increase working time by reducing time spent in leisure, transportation, other and personal care and health.

5 Conclusion

The goods-time use elasticities having values lower than one imply that goods intensive consumption is limited due to an existing complementary relationship between time and commodity use. The level of complementarity as the elasticity of substitution between inputs in domestic production can be measured by a double logarithmic function of consumption per time use and wage rate, as proposed by Hamermesh (2008). However, we have shown in this paper that the goods-time elasticity of substitution measurement needs to be corrected by the capacity to increase working hours when opportunity cost of time use changes. The idea underpinning this is that households may have lower discretionary times use in certain activities such as food, housing, and clothing (meaning that a good intensive consumption pattern exists for these necessities) for which the domestic production have complementary rather than substitutionary. Thus, the demand elasticity of working time available is limited since the scarcity of time use is important for these activities. On the other hand, households are more inclined to increase working time by reducing time spent in leisure, transportation, other and personal care and health, a tendency that in turn yields good intensive consumption in Turkey. To show this, we first proposed to measure opportunity cost of time for each household with regard to their consumption groups and to socioeconomic factors such as the size of the household, level of education, age, neighborhood etc. for Turkey in 2007. Our elasticity estimation result for food is 0.50, approximate to those obtained by Hamermesh (2008), Chin (2008), Baral et al. (2011), Davis and You (2013) and Canelas et al. (2014) ranging between values 0.22 to 0.56. When we re-estimate the regression, the elasticity of substitution for food rises to 0.92, becoming more commodity intensive. Furthermore, we get more elastic substitution values between time and commodity such as at leisure, transport, personal care with health and other activities in Turkey for 2007. We find that the substitution between time use and commodity increased, meaning that the dispersion of time use elasticities is getting close to being unitary, once all consumption groups are considered, owing to more elastic working being available in activities such as health with personal care, transportation, leisure, and others groups.

Appendix

Table 4: Summary Statistics

Household Budget Survey 2007 (Original Data)					
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Food Exp.	24844	346,77	207,01	0,00	2662,50
Health + Perso Care Exp.	24844	92,95	252,44	0,00	7073,32
Housing Exp.	24844	451,38	371,66	7,62	10321,00
Clothing Exp.	24844	85,92	149,05	0,00	2462,50
Education Exp.	24844	34,43	334,43	0,00	20250,00
Transport Exp.	24844	158,91	370,71	0,00	7890,00
Leisure Exp.	24844	33,80	127,31	0,00	4007,50
Other Exp.	24844	19,56	71,41	0,00	2009,00
Sex	24844	1,52717	0,4992713	1	2
Age	24844	2,9166	1,584314	1	6
Marital Status	24844	1,827926	0,5967679	0	5
Education	24844	2,539124	1,188016	1	5
Firm Status(Private or Public)	24844	0,5002818	0,6035958	0	2
Working Status (Slary, Self employed. . .)	24844	1,09129	1,629773	0	5
Working Sector (Agriculture, construction. . .)	24844	1,97601	2,923681	0	9
Geographic (Rural, Urban)	24844	1,675294	0,4682744	1	2
Time Use Survey 2006 (Original Data)					
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Food TU.(hour-month)	10893	38,90	36,78	0,00	477,33
Health + Perso Care TU.(hour-month)	10893	157,14	83,09	0,00	476,33
Housing TU.(hour-month)	10893	89,04	37,35	4,00	407,33
Clothing TU.(hour-month)	10893	9,02	21,09	0,00	302,00
Education TU.(hour-month)	10893	23,75	33,41	0,00	369,67
Transport TU.(hour-month)	10893	81,66	112,47	0,00	618,67
Leisure TU.(hour-month)	10893	40,24	49,02	0,00	292,00
OtherTU.(hour-month)	10893	23,66	50,68	0,00	430,33
Sex	10893	1,526852	0,4993014	1	2
Age	10893	3	1,581255	1	6
Marital Status	10893	1,849904	0,587668	0	5
Education	10893	2,553016	1,197478	1	5
Firm Status(Private or Public)	10893	0,5281373	0,5998091	0	2
Working Status (Slary, Self employed. . .)	10893	1,228863	1,709977	0	5
Working Sector (Agriculture, construction. . .)	10893	2,060865	2,970269	0	9
Geographic (Rural, Urban)	10893	1,64546	0,4783955	1	2
Budget Shares (Matched Data)					
Monetary Expenditures	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Food Exp.	24831	0,3369	0,1516	0	0,9097
Health + Perso Care Exp.	24831	0,0637	0,0790	0	0,9090
Housing Exp.	24831	0,3857	0,1589	0,0349	1,0000
Clothing Exp.	24831	0,0619	0,0706	0	0,5694
Education Exp.	24831	0,0163	0,0572	0	0,8726
Transport Exp.	24831	0,1010	0,1169	0	0,8622
Leisure Exp.	24831	0,0214	0,0494	0	0,6472
Other Exp.	24831	0,0131	0,0379	0	0,7920
Full Expenditures	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**
Food Exp.	24831	0,2235	0,0758	0	0,5520
Health + Perso Care Exp.	24831	0,1215	0,0452	0	0,6443
Housing Exp.	24831	0,2346	0,0837	0,0302	0,6553
Clothing Exp.	24831	0,0464	0,0413	0	0,4273
Education Exp.	24831	0,0371	0,0413	0	0,7995
Transport Exp.	24831	0,0945	0,0695	0	0,6155
Leisure Exp.	24831	0,1644	0,0584	0	0,5797
Other Exp.	24831	0,0781	0,0675	0	0,5033

Table 5: Time Use Substitution Elasticity Estimates for Eight Consumption Groups (Equation 25)

	$\ln(\frac{m_{food}}{t_{food}})$	$\ln(\frac{m_{h\&pc}}{t_{h\&pc}})$	$\ln(\frac{m_{house.}}{t_{house.}})$	$\ln(\frac{m_{cloth.}}{t_{cloth.}})$	$\ln(\frac{m_{educ.}}{t_{educ.}})$	$\ln(\frac{m_{trans.}}{t_{trans.}})$	$\ln(\frac{m_{leisure}}{t_{leisure}})$	$\ln(\frac{m_{other}}{t_{other}})$
$\ln(\omega_h)$	0.502***	0.834***	0.963***	0.892***	1.208***	1.303***	0.123	0.482*
	(8.34)	(6.84)	(16.35)	6.44)	(8.08)	(9.98)	(0.77)	(2.53)
$\ln(\nu_{food})$	-0.921***	-	-	-	-	-	-	-
	(-77.89)	-	-	-	-	-	-	-
$\ln(\nu_{h\&pc})$	-	-1.306***	-	-	-	-	-	-
	-	(-13.99)	-	-	-	-	-	-
$\ln(\nu_{house.})$	-	-	-0.995***	-	-	-	-	-
	-	-	(-79.58)	-	-	-	-	-
$\ln(\nu_{cloth.})$	-	-		-0.834***	-	-	-	-
	-	-	-	(-28.89)	-	-	-	-
$\ln(\nu_{educ.})$	-	-	-		-0.967***	-	-	-
	-	-	-	-	(-20.90)	-	-	-
$\ln(\nu_{trans.})$	-	-	-	-	-	-1.375***	-	-
	-	-	-	-	-	(-15.53)	-	-
$\ln(\nu_{leisure})$	-	-	-	-	-		-1.751***	-
	-	-	-	-	-	-	(-15.38)	-
$\ln(\nu_{others})$	-	-	-	-	-	-		-1.715***
	-	-	-	-	-	-	-	(-14.49)
Household size	0.456***	-0.262	-0.263**	0.330	-0.373	-0.499**	-0.526*	-0.256
	(5.08)	(-1.39)	(-2.92)	(1.64)	(-1.63)	(-2.64)	(-2.13)	(-0.87)
Pre-primary Education	-0.0663	-0.744**	-0.341**	-0.462	-1.060***	-0.666**	-0.825*	-0.465
	(-0.56)	(-2.97)	(-2.82)	(-1.73)	(-3.49)	(-2.64)	(-2.50)	(-1.20)
Elementary School	-0.242***	-0.732***	-0.292***	-0.658***	-0.900***	-0.619***	-1.114***	-0.686***
	(-4.13)	(-5.93)	(-4.96)	(-5.03)	(-6.03)	(-4.91)	(-6.88)	(-3.54)
Middle School	-0.231**	-0.564***	-0.261***	-0.531**	-0.737***	-0.640***	-1.019***	-0.592*
	(-3.05)	(-3.55)	(-3.45)	(-3.13)	(-3.84)	(-3.99)	(-4.89)	(-2.39)
High School	-0.136*	-0.520***	-0.215***	-0.252*	-0.246	-0.437***	-0.768***	-0.216
	(-2.38)	(-4.36)	(-3.77)	(-1.98)	(-1.71)	(-3.65)	(-4.90)	(-1.17)
House Possession	0.0162	0.114	0.139**	0.148	0.113	0.00963	0.00349	0.0547
	(0.36)	(1.19)	(3.03)	(1.45)	(0.97)	(0.10)	(0.03)	(0.37)
ln(age)	-2.196	-0.782	-1.219	-4.845	-5.804	-2.547	-0.282	-8.598
	(-1.60)	(-0.27)	(-0.88)	(-1.58)	(-1.63)	(-0.88)	(-0.07)	(-1.92)
$[\ln(\text{age})]^2$	0.329	0.131	0.177	0.715	0.932	0.367	0.116	1.290*
	(1.67)	(0.32)	(0.89)	(1.62)	(1.83)	(0.88)	(0.21)	(2.00)
Area(Urban)	-0.0825	-0.0966	0.299***	0.280*	0.535***	0.0113	0.264	0.126
	(-1.62)	(-0.91)	(5.91)	(2.47)	(4.18)	(0.11)	(1.90)	(0.77)
Constant	5.362*	(2.111	3.797	8.070	8.486	5.618	0.365	14.35
	(0.42)	(1.57)	(1.51)	(1.36)	(1.11)	(0.06)	(1.84)	(0,00)
r2	0.864	0.115	0.880	0.497	0.500	0.330	0.168	0.0988
chi2	6697.4	312.5	7270.6	978.0	802.5	570.4	380.1	255.1
p	0	1.99e-60	0	1.03e-202	5.41e-165	2.97e-115	1.02e-74	2.37e-48

t statistics in parentheses

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

Table 6: Corrected Time Use Substitution Elasticity Estimates for Eight Consumption Groups (Equation 26)

	$\ln(\frac{m_{food}}{t_{food}})$	$\ln(\frac{m_{h\&pc}}{t_{h\&pc}})$	$\ln(\frac{m_{house.}}{t_{house.}})$	$\ln(\frac{m_{cloth.}}{t_{cloth.}})$	$\ln(\frac{m_{educ.}}{t_{educ.}})$	$\ln(\frac{m_{trans.}}{t_{trans.}})$	$\ln(\frac{m_{leisure}}{t_{leisure}})$	$\ln(\frac{m_{other}}{t_{other}})$
$\ln(\frac{\omega}{\nu})_{food}$	0.925***							
	(75.43)							
$\ln(\frac{\omega}{\nu})_{h\&pc}$		1.180***						
		(16.80)						
$\ln(\frac{\omega}{\nu})_{house.}$			0.995***					
			(80.03)					
$\ln(\frac{\omega}{\nu})_{cloth.}$				0.813***				
				(28.58)				
$\ln(\frac{\omega}{\nu})_{educ.}$					0.973***			
					(21.21)			
$\ln(\frac{\omega}{\nu})_{trans.}$						1.458***		
						(25.13)		
$\ln(\frac{\omega}{\nu})_{leisure}$							1.147***	
							(12.73)	
$\ln(\frac{\omega}{\nu})_{other}$								1.372***
								(14.66)
Household size	0.449***	-0.239	-0.264**	0.344	-0.373	-0.513**	-0.466	-0.159
	(4.83)	(-1.27)	(-2.93)	(1.71)	(-1.63)	(-2.68)	(-1.87)	(-0.54)
Pre-primary Education	0.0226	-0.692**	-0.334**	-0.486	-1.107***	-0.640*	-0.774*	-0.295
	(0.18)	(-2.76)	(-2.77)	(-1.83)	(-3.65)	(-2.53)	(-2.33)	(-0.76)
Elementary School	-0.166**	-0.657***	-0.286***	-0.661***	-0.944***	-0.605***	-0.991***	-0.446*
	(-2.77)	(-5.41)	(-4.93)	(-5.13)	(-6.42)	(-4.93)	(-6.11)	(-2.37)
Middle School	-0.166*	-0.496**	-0.256***	-0.523**	-0.775***	-0.627***	-0.912***	-0.383
	(-2.13)	(-3.15)	(-3.40)	(-3.09)	(-4.05)	(-3.93)	(-4.35)	(-1.57)
High School	-0.119*	-0.213***	-0.258	-0.789***	(-2.01)	(-3.75)	(-1.78)	(-4.99)
	-0.498***	-0.243	-0.433***	-0.130	(-4.18)	(-1.91)	(-3.58)	(-0.70)
House Possession	-0.0231	0.0794	0.136**	0.151	0.135	-0.00687	-0.0995	-0.0134
	(-0.49)	(0.83)	(2.99)	(1.50)	(1.17)	(-0.07)	(-0.79)	(-0.09)
ln(age)	-2.504	-1.241	-5.711	0.655	(-1.76)	(-0.90)	(-1.60)	(0.17)
	-0.969	-4.886	-2.815	-10.01*	(-0.34)	(-1.60)	(-0.96)	(-2.23)
$[\ln(age)]^2$	0.372	0.180	0.918	-0.0597	(1.82)	(0.91)	(1.80)	(-0.11)
	0.156	0.723	0.406	1.492*	(0.38)	(1.64)	(0.97)	(2.32)
Area(Urban)	-0.147**	0.294***	0.570***	0.188	(-2.83)	(5.89)	(4.50)	(1.34)
	-0.138	0.300**	-0.0118	0.00965	(-1.31)	(2.69)	(-0.11)	(0.06)
Constant	5.794*	3.827	8.396	-1.707	(2.33)	(1.59)	(1.34)	(-0.26)
	2.242	8.162	6.042	15.96*	(0.44)	(1.53)	(1.18)	(2.04)
r2	0.854	0.125	0.880	0.499	0.498	0.318	0.169	0.104
chi2	6105.5	342.0	7331.7	942.7	791.1	688.3	301.3	239.9
p	0	2.00e-67	0	4.00e-196	1.73e-163	2.08e-141	8.38e-59	7.35e-46

t statistics in parentheses

* $p<0.05$, ** $p<0.01$, *** $p<0.001$

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