

Household production or leisure?
A study of grocery and other shopping
(Preliminary Draft)

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I. Introduction

People's shopping behavior attracted some attention before the various time-use studies, subject to the *identical* time constraint, focused on different types of activities in our daily life. The consumption of market goods and the time spent on consumption are, according to the prevailing theories, both inputs in the process of household production.

There're some questions arising naturally. Who does/do the shopping within a family? From the perspective of welfare analysis, the decision to become a principal shopper within a family sometimes is related to one's skill on shopping, or, in other words, the productivity with respect to the time input on consuming activity. Some time-use studies focus on the bargaining behaviors between family members doing chores or enjoying leisure time. The relative market productivity of a family member could affect the intrahousehold time allocation on other activities. Invoked by those studies, I turn to think about the features of shopping activity since, unlike other types of housework, it is outdoor activities. On one hand, the different economic backgrounds of household members lead to bargaining and agreement on time allocation. On the other hand, the decision on who to shop with may reflect people's preference on socializing behaviors including spending time with their spouses or friends. Another point is that what to buy may directly indicate the purpose of shopping.

Generally, the shopping activities are much likely to be multi-purpose. They link the consumption of market goods and the time input on household production, and sometimes even leisure time altogether.

The major contribution of this paper is to shed light on the nature of shopping activities. I take care of grocery and other shopping activities as different types of activities in households' time allocation. The ATUS 2003 data set gives me a good view of shopping categories. I find that

individual demographics and household demographics are fairly important factors in determining the amount of time allocated on a certain activity. I combine these variables with people's income and wage rates, while focusing on comparing their marginal effects on the value of both two types of shopping time. The marginal effect of the same determinants on the time spent in aggregate work, leisure and home production is also reported. Generally, I compare the five activities at the same time, applying a nonlinear estimation methodology. Rather than dealing with the total time of shopping within a *week*, this paper, using single-day time diaries, attempts to capture determinants on people's total shopping time on a *typical day*. In order to display the weekly fluctuations and seasonal properties, basic indicators of timing on shopping are also included in the analysis.

The rest part of this paper is organized as follows: In Part II, I briefly summarize some closely related theoretical and empirical literature; In Part III, I describe the empirical methodology and Part IV discusses some data issues; In Part V, empirical results are listed; and Part VI concludes the paper.

II. Literature Summary

Identifying shopping

In the literature of time use research, shopping (especially grocery shopping) activities are identified as part of time input of household production in most studies on aggregated time categories. For example, Bhat and Koppelman (1993) identified three broad types of activities: subsistence, maintenance, and discretionary. Subsistence activity refers to work or work-related business. Maintenance activity pertains to the purchase and consumption of goods and services, where grocery shopping is an important component. Discretionary activity refers to the leisure

activity. When the grocery shopping is representative as a time input to household production, it was even used as a proxy for time devotion to home production. Kan and Fu (1997) used the monthly frequency of grocery shopping to approximate time input to the household production process when they analyze the data of married women in Taiwan. They examine the effect of working status on grocery shopping behaviors. Although the length of time is not mentioned in this study, it can still shed light on people's time use pattern under different working status. Although the literature hasn't theoretically or empirically separate shopping time by commodities, the data I use allows me to do comparative analysis between two categories of shopping time.

Time, expenditure and timing

Shopping time is different from other time since it's directly related to expenditure on market goods. Time spent shopping can lower purchasing price, which makes relation between time and expenditure ambiguous, if one fail to distinguish comparison shopping from total shopping time. Two early studies simultaneously estimate grocery shopping time allocation and expenditure. Blaylock and Smallwood (1987) focus on married couples' decision on shopper choice, while Kolodinsky and LaBrecque (1996) look at one person's minutes on shopping and compare the case of US and Canada.

To further analyze the substitution between time and money, studies on consumers' behavior (Marmorstein, Grewal and Fish, 1992; Hornik, 1984) suggest that not only the value of time measured by wage rate, but also the subject perception of time or enjoyment of shopping is an important factor.

The shopping-hour regulations affect time as well as timing of shopping in European countries. Jacobsen and Kooreman (2004) compare the total shopping time on different day of the week

and among different years before and after shopping hour regulations in Netherlands. They also estimated sub-samples based on genders and marital status.

Methodology

Since previous studies are more specific to shopping time with price and expenditure, simultaneous estimation are applied to analyze people's joint decision on time and expenditure. Nonlinear estimation is used for discrete choice (Kan and Fu, 1997; Blaylock and Smallwood, 1987) or continuous time devotion (Kolodinsky and LaBrecque, 1996). The current study intends to look at the determinants on two different shopping time use and compare them with other time categories. It also accounts for timing that lead to time allocation on different categories over time. The important implication from wage and income effect not only differentiates shopping from other activities, but also supports the assumed connection between time, income and expenditure.

When there's no research refer to any multi-purpose characteristic of shopping activities, the method to empirically identify a certain type of time category and come it with other category has been applied on other topic. Kimmel and Connelly (2006) separate mothers' time use pattern with time devoted on childcare from home production and leisure. They compare the wage effect on mother's time and find significantly different marginal effects of determinants of minutes spent on childcare, leisure, home production and employment. Instead in this paper, the marginal effect of determinants of time on grocery shopping and other shopping will be compared with the corresponding marginal effects on work, leisure and home production by similar methodology.

III. Empirical Model and Methodology

The empirical hypothesis I want to test following the objective of the paper is whether the determinants have different marginal effects on time spent on grocery shopping and other shopping activities. The basic equation for estimation is

$$t_i = \alpha \times indemo_i + \beta \times hhdemo_i + \eta \times wage + \gamma \times income_i + \delta \times other_i + \varepsilon_i$$

The total time of shopping spent within a typical day responses to several group of variables. The individual demographics include age and sex. The gender's marginal effect is more likely to capture the difference in shopping skills and personal preference towards the shopping activity. Women are expected to do more shopping generally, given the family and economic backgrounds.

The household demographics refer to the number of family members. Rather than reporting a total number, I have several variables indicating the presence of spouse, presence of kids in several age categories, as well as presence of other adults within the household. The family size is expected to be positively associated with time devoted to essential food or grocery shopping, while this connection does not necessarily exist with shopping on other commodities that does not satisfy people's basic requirements or can be shared with other family members. Marriage and a large family may bring more shopping as part of chores, but the other adults can release the time constraint of the respondent. Therefore, I expect different effect from different types of family member. The presence of other adult in the family is likely to share the task of routine house works and grocery shopping.

The change of respondents' hourly wage rates, or to say the value of time by measuring forgone earning, are expected to influence time allocation by substitution effect and income effect at the same time. For a person working for pay, the wage rate of market work will affect the time distribution on shopping or other activities due to marginal rate of substitution of productivity on

different activities. Meanwhile, his time allocation will also be affected by income shock due to change in wage rates, especially for those live as the main source of income in a family. His shopping behavior will be affected by his own non-labor income and earning from other family members. Due to lack of information on actual total family income and its high correlation to the earnings of each family member, I use the spouse's earning if the person is married as an alternative source of non-labor income. The expected sign of marginal effect from income is ambiguous. The income that determines household expenditure, will affect time spent on purchasing market goods. It's different from the way that income may affect other house works or leisure time. The implicit comparison shopping time makes the results uncertain. Shopping for different commodities may also imply different response to income shock.

The last group of variables measure timing effect, which is thought to be very important feature of shopping behavior. While many other studies separate the weekday and weekends samples, I run this pooled estimation with the day dummy variables of Friday, Saturday and Sunday. Since the data is randomly sampled on different weekdays, I am able to find parametric difference of Friday if it's different from other weekdays and weekends. There's less than one percent of the sample reporting a holiday on the survey day. I simply drop this tiny part of sample in our estimation, since the paper is interested in the time use pattern on a typical day. The additional variables in this group are the quarters of the year. Shopping is a typical seasonal activity and people's shopping behavior can be connected with some traditional holidays. I can reasonably expect a shopping fluctuation in the last quarter of a year, although the data information is collected on non-holidays.

The basic equation is the general specification for estimation on the time spent on two categories of shopping. In order to compare the directions and magnitudes of marginal effect, the shopping

time estimations are jointly run with work time, leisure time and home production time estimations.¹ Since time allocation on different types of activities are determined by given individual's all assumed exogenous characteristics, it's hard to say that each partial time decision is made independently. With the fixed total time available, each part of time may be jointly determined with others. Some activities may be competitive in time, and others might be less correlated. This is a multivariate limited dependent model with five equations. The five dependent variables that sum to twenty-four hours are endogenous. The error terms of each equation have zero means and variance-covariance matrix Σ , where they are assumed correlated with each other. The tobit estimation is applied for each equation, but the leisure time is the only variable not censored.

IV. Data

The American Time Use Survey (ATUS) 2003 reports its interviewee's 24-hour time dairies on the day before interviewed. Every detailed activity within a typical day is provided precisely with start time and stop time as well as who is doing together. Each individual is selected to be interviewed on a designated day. People's time allocation on different days of a week from Sunday to Monday can be collected and compared. The respondents' family and economic backgrounds are also provided.

The number of total complete interviews is 20,720, among which more than 5000 respondents report on food, gas or grocery shopping. And the number of respondents reporting positive time on other commodity shopping is also above 5000. I use the sample aged between 18 and 65 from the original data set. It is consistent with Jacobsen and Koorman's (2004) study on shopping time.

¹ Kimmel and Connelly (2006) estimate four equations on leisure, home production, employment and childcare. I apply their code assignment for work, leisure and home production. The childcare is grouped with home production, and shopping is separated from home production.

As Jacobsen stated, this age restriction incorporate people who are most likely to be choosing actively among working, shopping, home production or leisure activities.² I use the current working group for estimation. Non-working group has different choice on employment and expected dramatic different time allocation on other activities, for which reason it's not pooled in regression. I get a usable sample size of 8841, after excluding invalid values for all variables used in estimation. I use the Tobit estimation for the sample when those observations not reporting positive time are censored to zero. This sample is estimated using five equations simultaneously. Although the total number of parameters to estimate increases more than five times, it should not be a big problem regarding to the adequate sample size.

Some used variables unavailable from the ATUS survey data such as education and spouse earnings are obtained from the Current Population Survey (CPS) survey data in the same year from the corresponding households. The spouses' earnings are collected from the corresponding households in CPS data set which includes all demographic and work-related information of each family member. All the characteristics of explanatory variables will be discussed in detail in next section when the descriptive statistics are presented.

VI. Empirical Result

Descriptive statistics and discussion

I have several tables that can shed light on general features of shopping activities while comparing between two categories and with leisure and home production. The shopping time is separated from leisure and home production while it is usually included in home production in most previous literature. Table 1 reports the average minutes on the diary day spent on two types

² The sample aged 18-65 incorporate people who are most likely to be choosing actively between shopping, working and leisure as opposed to being retired or not yet in the labor force. See Jacobsen and Kooreman (2004), pg.12.

of shopping as well as the minutes on work, home production and leisure activities. The minutes are reported for the whole sample and by gender as well. For both shopping and home production, larger percent of the female sample report positive minutes than male do, and the mean value of time reported by female is also greater. The average leisure time of men and women are relatively close to each other although men are still enjoying more leisure on average. The female's domination of time on shopping and household production can be due to their relative advantage on productivity and can also represent their preference on shopping activity if it's more leisure intensive for women.

Table 2 exhibits the mean values of time spent on different days of a week. Since the data is randomly sampled on each weekday, I am able to compare Friday with other weekdays. The weekly picture of time use pattern shows that the assumption of 'unique' Friday is generally supported. Time allocation on Saturday and Sunday are similar to each other. However, people enjoy more leisure time on Sunday, while Saturday is obviously a super shopping day for non-grocery commodities. Friday is nothing more than other weekdays for grocery shopping, but other shopping is much more frequently done on Friday even than Sunday. The most significant fluctuation happens on household production, since it decline only on Friday. This is consistent with an increasing on leisure time on Friday that people tend to relax after a whole week's work instead of regular chores throughout the week.

The seasonal property of shopping behavior is when I deal with a data randomly sampled throughout a year. Table 3 gives out a picture of quarterly fluctuation. Grocery shopping time is distributed evenly across quarters with a marginal increase in the first quarter. On the contrary, the other stores are much more crowded during the last three month of the year. The holiday season brings out the incentive to shop. For the home production and leisure activities, there's no

significant seasonal fluctuation as I expect, this also implies that it's meaningful to separate the shopping activities for specific study.

Table 4 present the descriptive statistics for the independent variables in the estimation sample for five activities. The spouses' wage is positive for those respondents with presence of spouse, but the mean value of the whole sample is reported. The wage rates are calculated from respondents' earnings and their working hours, and the mean is presented in logged value. More than 80 percent of the sample located in metropolitan area. The sample is distributed evenly across month and weekdays, but the weekends are over sampled.

Estimation Results

Table 5 reports the results of five regressions. According to Kan and Fu (1997), the time use pattern on shopping can be different for working and non-working people, which is reflected through the sign and magnitude of parameters. It is necessary to separate the sample by labor force status in this study, and the estimation for non-working sample should use different equation system.

The individual demographic variables showed very interesting results. The age is generally positively associated with shopping and leisure, while negatively associated with working and home production. The gender difference is mostly consistent as expect. Men have significant lower time devotion on shopping and home production, but work more enjoy more leisure time as well. The coefficients in home production and work equation are almost equal in magnitude. It's much likely that men substitute time from house works to market work, and prefer more other leisure time rather than shopping. But it's difficult to conclude that women like shopping more than men do unless we know that they have difference response on time and expenditure to

income. This also implies that it's meaningful to stratify the sample by gender in estimation for further analysis.

Family demographic variables tell information on the nature of shopping behavior. The presence of spouse leads to more time on home production time but less time on grocery shopping. The other activities are not significantly affected. The marriage changes the structure of a family and brings out more work at home, but grocery shopping as a single activity can be completed by spouse instead sometimes. Presence of young kids in the family definitely raises the time on childcare and it is thoroughly included in home production in our study. Much of this time devotion comes from sacrificing leisure time and working time. This is consistent with Kimmel and Connelly's (2006). More kids increase grocery demand and it is reflected through positive significant association, while non-grocery shopping though not significant, display mostly negative effect. It's weakly implied that grocery shopping is more like home production and other shopping is more like leisure. Presence of other adults in the family will increase grocery need on one hand, and release the time constraint of respondents on the other hand. The coefficients are negative in all equations but the work equations and insignificant in leisure equation. The respondents obviously have other adults in the family to share their non-market work and this is strong implied on the case of shopping.

According to the theoretical implication, the wage effect is hard to predict since the time allocation between market work and home production is not only bounded by the substitution of productivities but also affected by the process of 'leisure production'. The rate of hourly market wage has positive and significant impact on two types of shopping. This kind of impact is also positive on leisure time, but negative on market time. Income effect dominates substitution effect

on leisure time, which helps to explain why higher hourly pay connects with shorter working hours.

The marginal effect from spouse earnings are also positive and significant in shopping equations, and negative in work equation but large and positive in home production equation. The possible reduction of comparison shopping due to higher income can hardly be supported or at least dominated by the opposite impact from increasing demand for market goods. It's interesting to see that higher own wage makes time allocation towards leisure, while higher non-labor income lead to heavy home production or even less leisure. This reflects the bargaining between working couples to some extent, although single person model is utilized here. However, whichever source of income facilitates time substitution towards shopping anyway. This shed light to the unique feature of shopping behavior, which connects expenditure on market goods with time input. It's more income sensitive and is always encouraged by income.

The quarter dummy variables of the year show that the seasonal fluctuation for non-grocery shopping comes to a peak at the end of a year with continuous growth throughout the year. It is opposite to case of grocery shopping. Average time on home production is especially long during the last quarter while the grocery shopping and work is shortened at that time. Leisure almost has nothing to do with seasons. The five categories display different trends over time of the year. The Friday dummy and two weekend dummies are highly significant as expect. Certain amount of time is transferred from market work to shopping and leisure on Friday although it's a working day. But home production only occupies weekends. Shopping on Saturday is fairly more than any other day of the week. The metropolitan status seems to have little impact on time use pattern.

VI. Discussion and Conclusion

It is very hard to give a precise definition for shopping activities when I try to say it is typically household production or pure leisure, not like watching TV as leisure or dish washing as chores. According to our major findings in this paper, time spent shopping for grocery or other commodities sometimes response in the same direction and sometimes not. But compared with direction and magnitude of marginal effect on aggregate time on market work, home production and leisure, the shopping time has larger change rate due to change in gender, wage, income and timing and smaller change rate due to other factors. Shopping is associated with positive income effect because people's consumption is stimulated by income and thus more time is spent in stores.

Quite a few kinds of activities in the big category of household production can be more or less leisure intensive. Kimmel and Connelly (2006) propose the childcare as an example and shopping could be another.

(Incomplete)

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Table 1: Average Minutes of Shopping, Work, Home Production and Leisure of Whole Sample and by Gender

	All	Male	Female
Minutes of shopping (including zeros)	47.18 (80.32)	40.29 (76.88)	52.56 (82.51)
Minutes of shopping (excluding zeros)	98.77 (91.70)	93.38 (93.50)	102.31 (90.34)
Minutes of grocery shopping (including zeros)	12.90 (30.22)	9.96 (26.38)	15.20 (32.74)
Minutes of grocery shopping (excluding zeros)	41.00 (41.85)	35.06 (39.63)	44.89 (42.81)
Minutes of other shopping (including zeros)	34.28 (72.52)	30.33 (69.98)	37.37 (74.31)
Minutes of other shopping (excluding zeros)	89.39 (93.75)	84.48 (95.22)	92.82 (92.58)
Minutes of Market Work (including zeros)	291.39 (285.43)	323.08 (299.05)	266.61 (271.78)
Minutes of Market Work (excluding zeros)	443.87 (237.53)	478.09 (241.29)	415.66 (230.64)
Minutes of HH production (including zeros)	167.33 (169.00)	133.01 (159.55)	194.18 (171.32)
Minutes of HH production (excluding zeros)	194.48 (167.07)	168.54 (162.07)	211.95 (168.14)
Minutes of leisure	934.09 (249.14)	943.62 (263.60)	926.65 (236.98)
Total Number of Observation	8841	3880	4961

Table 2: Average Minutes of Shopping, Work, Home Production and Leisure by Days of a Week

	Monday- Thursday	Friday	Saturday	Sunday
Minutes of grocery shopping (excluding zeros)	32.72 (34.75)	30.92 (32.96)	46.96 (46.77)	48.87 (44.56)
	0.27	0.33	0.36	0.33
Minutes of other shopping (excluding zeros)	61.72 (70.29)	70.77 (83.02)	117.07 (109.33)	93.38 (90.20)
	0.32	0.41	0.48	0.37
Minutes of work (excluding zeros)	525.26 (187.78)	504.23 (190.62)	324.90 (252.06)	254.38 (243.92)
	0.89	0.88	0.47	0.40
Minutes of HH production (excluding zeros)	159.32 (147.30)	153.03 (148.16)	228.10 (181.92)	229.72 (171.57)
	0.86	0.84	0.86	0.87
Minutes of leisure	808.24 (200.98)	828.60 (197.22)	1018.69 (236.96)	1085.16 (228.26)

Table 3: Average Minutes of Shopping, Work, Home Production and Leisure by Quarters of a year

	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
Minutes of grocery shopping (excluding zeros)	44.78 (44.58)	37.77 (40.24)	39.35 (41.78)	41.97 (43.31)
	0.33	0.32	0.33	0.28
Minutes of other shopping (excluding zeros)	85.68 (88.17)	83.53 (91.60)	87.37 (89.46)	101.32 (104.51)
	0.36	0.39	0.39	0.39
Minutes of work (excluding zeros)	443.48 (241.79)	449.09 (236.89)	451.57 (231.87)	430.11 (239.06)
	0.67	0.68	0.65	0.63
Minutes of HH production (excluding zeros)	190.53 (167.02)	194.55 (160.58)	189.78 (163.93)	203.71 (176.34)
	0.85	0.86	0.86	0.87
Minutes of leisure	934.17 (253.64)	924.74 (246.85)	936.38 (247.28)	940.96 (248.37)

Table 4: Descriptive Statistics of the Independent Variables

Variable	Mean	Std. Dev.
Individual Characteristics		
Age (in years)	40.27	11.50
Male	0.44	0.50
Hispanic	0.11	0.31
Education (in years)	14.02	2.79
Household Characteristics		
Presence of spouse	0.53	0.50
Presence of kids 0 to 2	0.10	0.30
Presence of kids 3 to 5	0.11	0.31
Presence of kids 6 to 13	0.27	0.44
Presence of kids 14 to 17	0.12	0.33
Presence of other adults	0.27	0.44
Income		
Wage rate (logged)	2.68	0.65
Spouse earning (in 1000 \$)	0.42	0.53
Other Variables		
Metropolitan Area	0.82	0.38
Apr-Jun	0.24	0.43
Jul-Sep	0.26	0.44
Oct-Dec	0.24	0.43
Friday	0.10	0.30
Saturday	0.26	0.44
Sunday	0.25	0.43

Table 5: Marginal Effects of Determinants of Time Spent on Shopping, Work, Home Production and Leisure

	Grocery	Nongrocery	Work	HHP	Leisure
Age	-0.74	-2.16	3.51**	7.59***	-9.43***
Age square	0.98	2.12	-4.44**	-7.42***	10.02***
Male	-10.90***	-11.02***	56.72***	-57.18***	10.00**
Hispanic	-0.20	-5.60	22.05***	-6.61	-17.81**
Education	-0.45	1.07**	5.20***	-0.67	-3.89***
Presence of spouse	-5.09**	-0.93	-6.00	9.53*	-5.84
Presence of kids 0 to 2	4.75*	-1.69	-34.99***	100.89***	-68.66***
Presence of kids 3 to 5	-3.84	-4.19	4.91	56.86***	-53.22***
Presence of kids 6 to 13	3.03	3.84	-23.41***	51.58**	-28.89***
Presence of kids 14 to 17	7.30***	-0.16	10.39	2.38	-12.15*
Presence of other adults	-5.92***	-7.61***	10.93*	-7.94**	-1.84
Wage rate	3.61***	4.07**	-16.09***	1.55	9.78***
Spouse earning	5.34***	6.37**	-22.75***	24.28***	-7.07
Metropolitan Area	0.73	-1.41	-3.87	-5.42	9.82*
Apr-Jun	-5.74***	5.19**	-5.98	8.24*	-2.51
Jul-Sep	-4.10*	6.83**	-10.24	3.15	5.06
Oct-Dec	-9.73***	9.16***	-27.93***	16.89***	4.23
Friday	6.33**	13.04***	-21.44**	-9.32	21.34***
Saturday	15.57***	48.92***	-326.87***	53.36***	203.66***
Sunday	12.15***	13.01***	-377.40***	54.13***	270.83***

* significant at 10%; ** significant at 5%; *** significant at 1%