

# Determining Factors and Their Interdependence in the Distribution of Household Labor Between Married Couples

Soo-kyeong Hwang  
Researcher, Korea Development Institute

## Abstract

Assuming that couples' time allocation decisions are not independent activities, this research has examined the determining factors of time allocation and their interdependence by using a simultaneous equations model. The empirical portion of the research makes use of the third-year Korean Longitudinal Survey of Women and Family (KLoWF) and segmented an individual's time into market labor, household labor, and leisure activities. According to the findings, the substitute effect between domestic labor and market labor of women was significantly weakened, and their husbands' time allocation had a minimal impact on women's time allocation. However, men's time allocation was greatly influenced by their wives' time allocation. Competition between husband and wife over housework was not detected, but both husband and wife placed additional time into housework when the amount of necessary household labor increased. This suggests that the burden of domestic labor, including care work, is not transferred from women to men but is replaced by marketization.

Keywords: Couples' time allocation, Non-market labor, Endogeneity, Two-stage estimation procedure, Marketization

## I. Issues

Decisions made by the individual family members constituting a household are unlikely to be independent from one another. In general, roles are shared among household members and are based on common goals. When young children who require focused care are involved, the conventional assumption is that family members make determinations such as one of the parents leaving the workforce or asking a grandparent to provide childcare. In relation to issues of familial care, consumption, and savings, some division of roles is a common practice among family mem-

bers; a special reward for such decisions is not generally considered.

Becker (1965) argued that ‘productive’ consumption, or household production, is conducted in order to maximize the happiness of the entire family and that the allocation of wealth and time is determined as part of this process. This notion has been formalized as the theory of allocation of time. The value of the time invested in household production can be measured as an opportunity cost, since it is obtained only upon the sacrifice of the potential income that would have been earned through market labor.

Becker also asserted that the allocation of time and the division of labor in human capital investment can occur between couples as profitability increases commensurate with the specialization of human capital. He explained that given women’s general competence in child-raising and household labor, time is allocated in such a way that women focus on household labor and men on market labor, all in order to maximize the effectiveness of the family as a community. This phenomenon is observed in a majority of nations to a greater or lesser degree.

Men and women in South Korea also exhibit mutually divergent patterns of time use. As of 2009, married women spend an average of 2 hours and 35 minutes in market labor and 4 hours and 7 minutes in household labor per day, while the average time spent by married men on these two types of labor is 5 hours and 10 minutes and 46 minutes, respectively (2009 South Korean Time Use Survey). Typically, men allocate a greater amount of time to market work and women to household work.

Table 1. Use of time per day by South Koreans aged 20 or older (2004 and 2009)  
(Unit: hour; minutes)

	Single		Married		Double-income		Single-income	
	Men	Women	Men	Women	Men	Women	Men	Women
Year 2004								
Market labor	4:08	4:10	5:28	2:43	6:34	5:14	6:26	0:05
Household labor	0:21	0:49	0:39	4:15	0:32	3:28	0:31	6:25
Total	4:29	4:59	6:07	6:58	7:06	8:42	6:57	6:30
Year 2009								
Market labor	3:51	3:52	5:10	2:35	6:20	5:06	6:08	0:02
Household labor	0:26	0:54	0:46	4:07	0:37	3:20	0:39	6:18
Total	4:17	4:46	5:56	6:42	6:57	8:26	6:47	6:20

Note: Double-income and single-income households refer respectively to those households among cohabitating married couples in the 20-60 age bracket in which both the husband and wife are working and to those in which only the husband is working.

Source: 2004 and 2009 Time Use Survey, Statistics Korea

Compared to 2004, in 2009 the overall amount of time dedicated to market labor declined, while men spent more time and women spent less at household work. A similar trend can be observed among single-income households (Table 1). It may still be too early to anticipate a change in the division of roles among South Korean couples, since participation in household labor by South Korean men remains at a minimal. However, it is worth continuing to monitor the trend.

The motive underlying this research is the question of what caused these changes in the time spent on housework by men and women. The household production model assumes that time allocation decisions between a husband and wife are mutually dependent, since the allocation of time between the two must be negotiated in order to produce optimum home goods, which is required in order to maximize efficiency within the household.

This paper examines how the allocation of time between a husband and wife is mutually interdependent and how it is determined. Chapter II offers an overview of previous studies related to married couples' decisions on time allocation. Chapter III details the methods used to analyze the interdependence of such decisions and estimation strategies. Chapter IV uses the Korean Longitudinal Survey of Women and Family (KLoWF) to investigate the characteristics of South Korean couples' time allocation and the interdependence of decision-making. Finally, Chapter V presents the limitations of this research and suggests remaining questions.

## II. Theoretical backgrounds and previous studies

Traditional theories of consumer behavior assume that households earn income through market work and purchase goods and services to maximize household efficiency. When household consumption is explored in greater detail, however, intermediate goods are purchased and processed prior to consumption at times (e.g. for cooking), and some services are provided within the home (e.g. laundry, cleaning, and childcare), while other goods such as clothing and furniture are consumed as they are. Gronau (1973, 1977) introduced the concept of production theory into this process in order to suggest a home production theory. As an example, furniture is not simply a unit to be consumed as an end good, but also a unit to produce those home goods required to maximize the effectiveness of the family by using goods purchased with the household income and time of the family members.

Examining couples' time allocation decision mechanisms within a household, Gronau (1973) measured the value of the time of wives who are responsible for producing household goods and analyzed the supply of women's labor while explicitly taking into consideration the time required for household production in order to establish both theoretically and empirically that the existence of non-market labor has a significant impact mainly on women's supply of labor, resulting in the elasticity of women's labor supply being higher than men's (1977). Rather than

a simple dichotomy of labor and leisure, it is currently a common practice for research on women's supply of labor to consider time allocation between market labor, household labor, and leisure activities.

When the apportionment of time is analyzed with a focus on women as mothers, some researchers underline the need to address care work separately from other types of domestic labor. Kimmel and Connelly (2007) considered household work and care work to be dissimilar in nature since, unlike other types of housework, there is no commercial substitute for care work able to fully replace it and parents experience a form of process utility through care work. Therefore, they claimed it to be more appropriate to consider four categories when analyzing maternal time allocation: market labor, household labor, care work, and leisure. Ja-young Yoon (2010) classified a mother's time into these four categories in order to examine the impact on her time allotment of two opportunity costs of time: wage, which is the value of market labor, and the price of childcare services required to substitute for her care work. This empirical research project employing South Korea's time use survey found that when the price of childcare services rose, market labor time decreased and care work time increased. To the contrary, an increase in the market wage led to an increase in market labor time and a decline in care work time. In addition, as their husbands' income rose, the value of or preference for care work became stronger, leading to a decrease in women's market labor time.

Noting that time is allocated as a unit of a household or couple rather than at the individual level, other researchers have further expanded the traditional time allocation model. Ashenfelter and Heckman (1974) used a family utility function and the time restrictions placed on a family to suggest that the labor supply among family members is interdependent. Considering that married couples' decisions regarding supply of labor are not independent, in place of a more traditional analysis method which estimates the labor supply of men and women separately, Lundberg (1988) used simultaneous equations that included household income and husband's wage income and work hours in both women's labor supply and their spouse's labor supply as explanatory variables. Van Soest (1995) conceptualized the family utility function to be a translog function in order to present a model that can simultaneously analyze decision making in relation to the labor supply of husband and wife. Among South Korean researchers, Hyeon-suk Kim (2009) adopted van Soest's model (1995) to determine the correlation between a husband's and a wife's work hours and leisure.

However, all these studies focusing on the interdependence of couples' time allocation failed to take into account household production or housework hours. It can be considered that these are research on aspects of labor supply in regards to a choice between labor and leisure rather than research into time allocation.

While there have been significant discussions and progress has been made related to the division and role of non-market labor in terms of women's time allocation decisions, there are fewer studies that have examined non-market labor in terms of the time allocation of a husband and

wife being mutually influential and simultaneously determined. A majority of research on couples' time allocation has included as explanatory variables the characteristics of the spouse's time allocation.

Hersch and Stratton (1994) explored the determination between husbands and wives of housework hours through an analysis of the impact of one spouse's market labor income and market labor hours. According to these researchers, a couple's housework hours were negatively related to the market labor hours of one member and the proportion of the spouse's income, but positively to their spouse's market labor hours. The finding that the member of a couple with a relatively higher income spends less time on domestic labor compared to their spouse can be explained with a human capital hypothesis or a bargaining hypothesis in the sense that the member with a competitive edge in the labor market is expected to have greater negotiating power.

Connelly and Kimmel (2007) examined the impact of a spouse's wage and characteristics of time allocation on determining non-market time by using the time categories of market labor, household labor, care work, and leisure in analyzing households containing both a husband and wife and at least one child aged less than 13 years. They found that the spouse effect in determining non-market hours was negligible overall, and in particular that the relative wage of a wife had a minimal impact on the couple's time allocation decisions. However, there was a significant positive relationship between the husband's and the wife's leisure time, suggesting a complementary relationship. Some of the findings of Connelly and Kimmel (2007), which conflict with those of Hersch and Stratton (1994), are in line with the results of Blau and Kahn (2007), who stated that the elasticity of women's labor supply against their spouse characteristics had declined considerably since the 1990s. In a context in which women's supply of labor and relative income constantly increase while they remain responsible for a significant portion of care work and household labor, this presents the possibility that men's influence on their wives' time allocation is gradually waning.

Meanwhile, Bloemen et al. (2010) suggested an analysis model in which the time allocation decisions of a husband and wife are made simultaneously in consideration of market labor, household labor, and care work under the assumption that a couple's time allocation decisions are interdependent. The researchers used a simulated maximum-likelihood estimation in order to estimate six time equations (by each spouse and in each of three time categories). According to the estimation, women's time allocation responded sensitively to individual factors and to the constitution of their family, but not to their spouse's individual factors. When these researchers used their results to analyze the correlation between the time allocation by a husband and wife, care work hours were complementary between the pair while household labor hours were substitute during weekdays but complementary during weekends.

Among South Korean researchers, Ji-mi Seong (2006) is the sole investigator to offer empiri-

ical discussion on the relationship between the time allocation of a husband and wife. In her research, Seong accessed the Korean Labor and Income Panel Study to examine the determinants in time allocation of working women and included as explanatory variables spousal time allocation along with their personal characteristics and those of their family. The time equations of women's market labor, non-market labor, and leisure were estimated by means of a Full Information Maximum Likelihood (FIML) model. According to the results, men's non-market labor hours were positively associated to the hours of their wife's market and non-market labor, but negatively related to leisure hours. Furthermore, men's leisure hours demonstrated a negative relationship with their wife's market labor hours but a positive one with the hours of their wife's non-market labor and leisure. Her finding that men's participation in non-market labor increases women's participation in market labor harmonizes with the household production model. However, what is notable from her findings was that an increase in men's non-market labor accompanied a commensurate increase in women's non-market labor but a decrease in women's leisure hours. Seong interpreted this to be a result of the dual burden of work and home that South Korean women are asked to bear. In the meantime, leisure time was complementary between husband and wife, as verified in other studies.

### III. Analytical model

The main focus of this research is to examine how the decisions of a husband and wife regarding market labor and household labor are mutually interactive. For example, when household production is considered, there are several tasks that need to be performed within the household and the limited time resources of a husband and wife should be allocated appropriately to complete the tasks. Therefore, the time spent by one spouse on a specific activity affects not only the time spent on that person's additional activities, but also the time spent by his/her spouse on that same activity.

Time use between a husband and wife for a specific activity can be related either positively or negatively. In the former case, it is likely to suggest a similarity in their preference for that activity (e.g. their common preference for market or non-market activities), while in the case of the latter, it may indicate that roles (e.g. cooking, laundry, etc.) are divided for an activity between the couple based on factors such as individual competitive advantage.

In order to identify the characteristics of interdependence within a couple's time allocation, the equations of the couple's time use must be simultaneously estimated. If two activities, market labor and non-market labor (housework), are assumed, the following equations are possible in terms of the couple's use of time ( $2 \times 2$ ):

$$\begin{aligned}
t_{imp}^* &= \quad + \alpha_{fp1}t_{ifp}^* + \alpha_{mu1}t_{imu}^* + \alpha_{fu1}t_{ifu}^* + \beta_{mp}X_i + \gamma_{mp}Z_{imp} + \epsilon_{imp} \\
t_{ifp}^* &= \alpha_{mp2}t_{imp}^* + \quad + \alpha_{mu2}t_{imu}^* + \alpha_{fu2}t_{ifu}^* + \beta_{fp}X_i + \gamma_{fp}Z_{ifp} + \epsilon_{ifp} \\
t_{imu}^* &= \alpha_{mp3}t_{imp}^* + \alpha_{fp3}t_{ifp}^* + \quad + \alpha_{fu3}t_{ifu}^* + \beta_{mu}X_i + \gamma_{mu}Z_{imu} + \epsilon_{imu} \\
t_{ifu}^* &= \alpha_{mp4}t_{imp}^* + \alpha_{fp4}t_{ifp}^* + \alpha_{mu4}t_{imu}^* + \quad + \beta_{fu}X_i + \gamma_{fu}Z_{ifu} + \epsilon_{ifu} \quad (1) \\
t_{ijk} &= \begin{cases} t_{ijk}^* & \text{if } t_{ijk}^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (i = 1, \dots, N; j = m, f; k = p, u)
\end{aligned}$$

Here,  $t_{ijk}^*$  indicates the optimum amount of time used for a specific activity  $k$  (market labor and housework) of household member  $j$  (husband and wife) in household  $i$ ;  $X_i$  represents the explanatory variables included in all the time equations, and  $Z_{ijk}$  refers to the explanatory variables unique to each time equation.  $\epsilon_{ijk}$  is an error term.

Estimation of the equations above entails several problems. First, the optimum amounts of time used included in these equations are limited dependent variables. In other words,  $t_{ijk}$  observed in the actual data reflects the original value only when  $t_{ijk}^*$  has a positive value, while it incurs left-truncation, which appears as 0, if it has a negative value. In this case, estimations need to be made using a limited variable model such as a Tobit model.

An additional problem is the endogeneity of explanatory variables. The coefficients of major interest in this research are the  $\alpha_{jk}$ s that show the interdependence of a couple's time allocation. However, the  $t_{ijk}^*$ s, which are included as explanatory variables in the right term, are not exogenous variables, but rather selection variables that are determined endogenously. In this regard, the above equations should be estimated as an endogeneity-considering simultaneous equations model. In the case of a simultaneous equations system in which the variables in the left term are limited dependent variables, the two-stage estimation procedure suggested by Nelson and Olson (1978) can be applied.

This procedure can be summarized as in the following. As the first stage, equations (1) will be converted to reduced equations, each of which then will be subjected to a regression analysis in order to obtain primary coefficient estimates. Next, the fitted values for the endogenous variables will be calculated from the coefficient estimates and replace the explanatory variables in the simultaneous equations. Finally, simultaneous equations will be re-estimated to obtain the desired coefficient estimates.

For the first stage, equations (1) can be restructured in the form of a reduced equation system of endogenous variables ( $t_{ijk}^*$ ) as in the following:

$$\begin{aligned}
t_{imp}^* &= \delta_{mp}X_i + \eta_{mp1}Z_{imp} + \eta_{fp1}Z_{ifp} + \eta_{mu1}Z_{imu} + \eta_{fu1}Z_{ifu} + \nu_{imp} \\
t_{ifp}^* &= \delta_{fp}X_i + \eta_{mp2}Z_{imp} + \eta_{fp2}Z_{ifp} + \eta_{mu2}Z_{imu} + \eta_{fu2}Z_{ifu} + \nu_{ifp} \\
t_{imu}^* &= \delta_{\mu}X_i + \eta_{mp3}Z_{imp} + \eta_{fp3}Z_{ifp} + \eta_{mu3}Z_{imu} + \eta_{fu3}Z_{ifu} + \nu_{imu} \\
t_{ifu}^* &= \delta_{fu}X_i + \eta_{mp4}Z_{imp} + \eta_{fp4}Z_{ifp} + \eta_{mu4}Z_{imu} + \eta_{fu4}Z_{ifu} + \nu_i
\end{aligned} \tag{2}$$

$$t_{ijk} = \begin{cases} t_{ijk}^* & \text{if } t_{ijk}^* > 0 \\ 0 & \text{otherwise} \end{cases} \quad (i = 1, \dots, N; \quad j = m, f; \quad k = p, u)$$

In this manner, all the endogenous variables are expressed as a linear function of exogenous variables  $X_i$  and  $Z_{ijk}$ . The fitted values  $\hat{t}_{ijk}^*$  can be determined by estimating the four equations above as a limited dependent variable model in order to obtain  $\delta_{jk}$  and  $\eta$ . Next, these  $\hat{t}_{ijk}^*$ s will be entered into equations (1) to estimate a simultaneous equations model and the intended estimates of coefficient  $\alpha_{jk}$ s can be obtained.

## IV. Empirical analysis

### 1. Data

Raw data from the third-year KLoWF was used to identify the status of time allocation of South Korean households. KLoWF launched its first survey in 2007 with 10,000 women in the 19-64 age bracket from among 9,000 households nationwide. It conducted its second survey in 2008 and the third in 2010. In the third, a total of 8,376 women from 9,329 households participated. Since it is a follow-up study, their ages ranged from 19 to 67.<sup>1</sup>

This study limited its analysis to the 25-59 age group among women who are living with a spouse. As a result, a total of 4,699 households were selected<sup>2</sup>, among which 2,277 (48.5%) were double-income, 2,103 (44.8%) single-income with only the husband working, 127 cases (2.7%) single-income with only the wife working, and 192 cases (4.1%) in which neither of them were working.

Time variables were separated into the market labor hours and household labor hours of husband and wife. The average number of market work hours per week was obtained by multiplying the average number of working days per week by the average working hours per day.

1 However, the actual data included one individual at the age of 68 and another at the age of 69.

2 A total of 20 households were found to include two couples, but they were excluded in order to address only household-based couples.



Working hours included those hours from all the jobs in which a relevant individual was involved. In order to determine average hours of housework (e.g. dish-washing, cleaning, taking care of children, etc.) per week, the housework hours on weekdays, Saturday, and Sunday were given a weight of 5, 1, and 1, respectively.

Major factors that affect household labor hours include the number of household members (particularly the number of children and their constitution) and household income. These household-specific variables were constructed from household data. In other words, the number of household members and familial relations were identified based on household members' relation with the head of the household and the number of children was obtained according to the categories of 0-2 years old, 3-6 years old, 7-12 years old, and 13-18 years old. It was also determined whether or not the couple was living with their parents and/or grandparents. Next, household information including average annual household income and home ownership status were combined.

Similarly to the calculation of working hours, the wage (income) variable, which shows the value of an individual's market labor, was determined by summing all wages (income) from all jobs in which an individual was engaged. Given that the number of those whose wage (income) variable was NA was 585 among a total of 2,404 working women, however, imputation through a regression analysis was used for correction.<sup>3</sup> In this manner, the value of the income of 522 out of 585 cases of women and 8 out of 28 cases of their spouses were corrected.

## 2. Characteristics of couples' time allocation

Table 2 shows the average weekly household labor hours and market labor hours of women and their spouses. According to the analysis, women spent an average of 23.4 hours per week on market labor and 32.9 hours on domestic labor, while for their spouses the figures were 46.9 hours and 3.8 hours, respectively. It seems apparent that there is a clear distinction in the allocation of time on market labor and housework between husbands and wives.

In the case of working women, while women's time spent on housework declines significantly as their market labor hours increase, their spouse's time in housework alters little. Even in households in which only the women are working, their husbands spend just slightly more time than their working peers. Overall, South Korean married men's participation in household labor was very low.

When men's housework hours were divided into weekdays and weekends (Table 3), men appeared to perform a greater proportion of the housework on weekends compared to on weekdays (7.3% on weekdays; 14% weekends). However, the gap between weekdays and weekends is larger among single-income households in which only men are employed than in double-

---

<sup>3</sup> A wage function was estimated using personal characteristics such as sex, age, and education, as well as business information such as industry, job, position, and company size. The wages (income) of those whose observed wage value were not available were estimated using the coefficient estimates obtained from the function. The results of the regression analysis used in the wage substitution are not included in this paper.

income households, implying that the content of domestic labor and the basis for time allocation might differ between single-income and double-income households.

Table 2. Couples’ weekly average market labor hours and household labor hours (Unit: time)

	Category	Total	Double-income households	Single-income households (only men working)	Single-income households (only women working)	Unemployed households
Women	Market labor	23.4	45.8	0.0	44.5	0.0
	Household labor	32.9	26.2	41.0	21.8	32.3
	Total	56.3	72.0	41.0	66.3	32.3
Men	Market labor	46.9	51.1	49.4	0.0	0.0
	Household labor	3.8	3.9	3.8	4.3	3.7
	Total	50.7	55.0	53.2	4.3	3.7
Number of households (%)		4,699 (100.0)	2,277 (48.5)	2,103 (44.8)	127 (2.7)	192 (4.1)

Source: 2010 Korean Longitudinal Survey of Women and Family

Table 3. Couples’ household labor hours and men’s share by percent (average hours per day) (Unit: time)

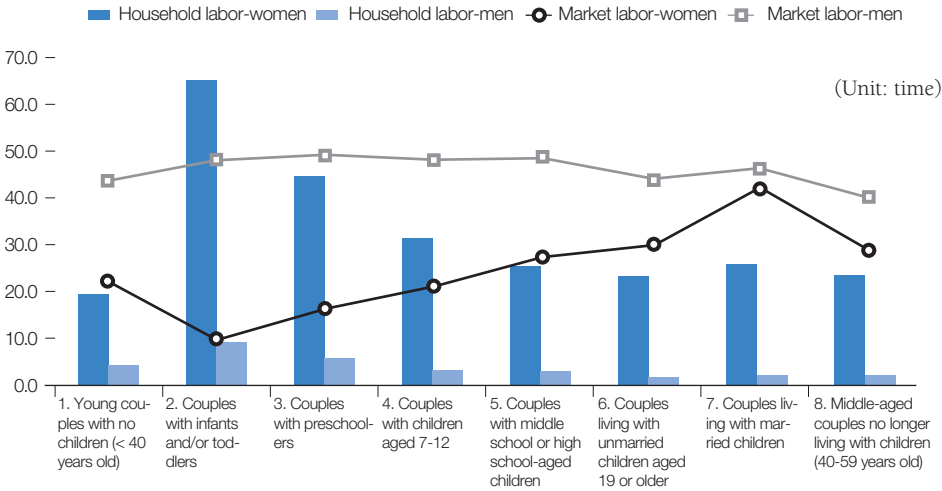
	Category	Total	Double-income households	Single-income households (only men working)	Single-income households (only women working)	Unemployed households
Women	Weekdays	3.6	2.8	4.6	2.3	3.7
	Weekends	7.4	6.2	8.9	5.1	7.0
Men	Weekdays	0.3 (7.3%)	0.3 (10.3%)	0.2 (4.7%)	0.5 (16.2%)	0.4 (10.5%)
	Weekends	1.2 (14.0%)	1.1 (15.6%)	1.3 (13.1%)	1.0 (16.5%)	0.8 (10.2%)

Note: Figures in brackets refer to the proportion of men’s share relative to total hours

Source: 2010 Korean Longitudinal Survey of Women and Family

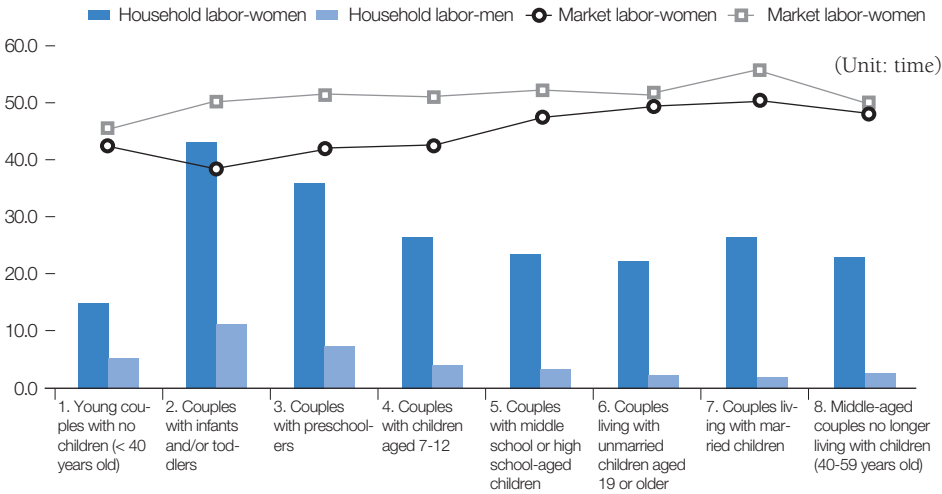
The patterns of time allocation in market and household labor are expected to exhibit a considerable difference by life stage of a household as it passes through the phases of childbirth, childcare, and separation of children from their parents. Figures 1 and 2 display the charac-

teristics of the household work hours of husband and wife by life stage. Although the data are cross-sectional, the difference by life stage of a household enables a prediction for the potential changes that may occur over a woman’s life course.



Source: 2010 Korean Longitudinal Survey of Women and Family

Figure 1. Couples’ use of time in market labor and household labor by life stage



Source: 2010 Korean Longitudinal Survey of Women and Family

Figure 2. Working couples’ use of time by life stage

As shown in Figure 1, when South Korean couples have infants and/or toddlers resulting in a surge in the amount of household labor, women assume the bulk of the burden, resulting in a drop in their market labor hours and a large increase in their housework hours. As to their male partners, however, their market work hours are barely affected and their housework hours increase only slightly.

Figure 2 demonstrates the pattern of time allocation by life stage of double-income households. The changes in the amount of time spent on housework by working women varied little from those for average married women. Except that their market work hours declined slightly when their children are young (infants/toddlers), the burden of market and housework labor borne by working women remains roughly the same throughout. All in all, a balance between home and work lives for South Korean working women appears to remain a distant dream.

What is interesting to note is that for women, market labor and housework hours are clearly substitutes for one another, although a difference exists in the degree between double- and single-income households, but no such clear substitute relationship is found with men. This indicates that men's market labor hours are little affected by their housework time. It would be meaningful to see if this finding were also supported by a microscopic analysis.

A further notable observation is that couples' housework hours appear to move in a synchronized pattern. This is because the male partner's participation in household labor increases when additional housework is required within limited familial resources, rather than housework hours being coordinated between a husband and wife. This phenomenon is more clearly observed among working couples. However, there is a need for this to be investigated in greater detail.

### 3. Spousal influence in time-allocation decisions

As discussed above, it is unlikely that married couples make independent decisions in terms of household time allocation. An individual's time allocation decisions for a range of activities are affected not only by themselves, but also by the time allocation of their spouse. In this section, an empirical analysis is attempted with a focus on how one partner's decisions on market work hours and housework hours affect a spouse's decisions regarding these hours.

Table 4 illustrates the definitions of the variables used in this analysis and the basic statistics. As household features, whether or not a family member requires intensive care, household income, home ownership status, and region dummy were considered. Regions were divided into *Gwang Yeok Si* (major cities) and provinces with the Seoul, Incheon, and Gyeonggi metropolitan area as a basis. As to personal features, age, education, monthly wage (income), and job type were considered. For women, whether the work is full-time or part-time was also taken into consideration.

Table 4. Definitions of variables and basic statistics

(Unit: time)

Definitions of variables		Average	Standard deviation
Women	Household labor	32.94	24.85
	Market labor	23.39	26.28
Their spouses	Household labor	3.85	6.57
	Market labor	46.86	17.77
Household features			
Log value of the number of household members (persons)		1.309	0.279
Infant/toddler (0-2 yrs) dummy		0.089	0.284
Preschooler (3-6 yrs) dummy		0.222	0.415
Children aged 7-18 dummy		0.521	0.500
Living with parents (grandparents) dummy		0.099	0.299
Home ownership dummy		0.711	0.453
Log value of the annual household income (10,000 won)		5.620	0.956
Region (with the Metropolitan area as a basis)	Gwang Yeok Si	0.075	0.264
	Gangwon region	0.011	0.104
	Chungcheong region	0.030	0.169
	Jeolla region	0.026	0.158
	Gyeongsang region	0.031	0.174
	Jeju/overseas	0.009	0.092
Women's personal features			
Age (with 55 yrs old or older as a basis)	25-34 yrs	0.144	0.351
	35-44 yrs	0.415	0.493
	45-54 yrs	0.305	0.460
Education (with middle school education or lower as a basis)	High school	0.448	0.497
	Two-year College	0.127	0.333
	Four-year University	0.184	0.387
	Graduate or higher	0.018	0.132
Log value of monthly average income (10,000 won)		4.617	0.647
Part-time		0.097	0.295
Job type (with manual labor as a basis)	Management/specialized area	0.100	0.300
	Clerical/sales/service	0.228	0.419
	Manufacturing	0.120	0.325
Spouse			
Age (with 55 yrs old or older as a basis)	25-34 yrs	0.077	0.266
	35-44 yrs	0.361	0.480
	45-54 yrs	0.336	0.472

Definitions of variables		Average	Standard deviation
Education (with middle school education or lower as a basis)	High school	0.386	0.487
	Two-year College	0.109	0.311
	Four-year University	0.290	0.454
	Graduate or higher	0.039	0.194
Log value of the monthly average income (10,000 won)		5.524	0.603
Job type (with manual labor as a basis)	Management/specialized area	0.122	0.327
	Clerical/sales/service	0.239	0.426
	Manufacturing	0.263	0.440

Household income, region dummy, age, and education were taken into account as common explanatory variables and other variables were included as explanatory variables for husband's and wife's time equations. Table 5 shows the results of estimation of each of the reduced equations of (2) using a MLE tobit model.

One commonality revealed by the four time equations was a negative relationship with other activities by an individual but a positive relationship with their spouse's time, regardless of the item. In other words, there is a clear substitute relationship between their own time categories but mixed effects are found between two spouses' time. However, as the results of this estimation simply show correlations without considering the interdependence of couples' time allocation decisions, more detailed interpretations will not be addressed in this section.

When it comes to determining factors for women's housework hours (first column), their hours tend to extend with the number of household members and infant/toddler and/or preschool children. Also, the more educated they are, the longer their household labor hours prove to be. This may be due to the following facts: the employment rate is low among highly educated women, there are more women with graduate or higher-level education in the younger age groups, and they may not yet be free from childcare duties. Meanwhile, there is a clear negative relationship with personal income: the time spent on housework goes down as wage rises and the market work hours increase.

Women's market work hours (second column) show a strong positive relationship with personal income<sup>4</sup> but a significant negative relationship with other income-related variables, including household income, home ownership, and spousal income. This suggests that income effect is dominantly manifest and the number of market labor hours is significantly low among those with higher education, the spouses of whom are assumed to have relatively stable incomes.

4 As for the reason why labor supply resiliency is so high, it is assumed that is it because the wage used in the analysis is a monthly rather than an hourly wage, which increases the value of time and therefore a substitute effect leads to not only increased market labor hours but also increased work hours and, correspondingly, an increased wage.

Table 5. Results of estimation of reduced equations

	Women		Men	
	Household labor hours	Market labor hours	Household labor hours	Market labor hours
Constant term	23.63 (5.66) **	-17.58 (-4.21) **	-6.12 (-2.35)	32.34 (9.14) **
Women-housework		-0.07 (-3.24) **	0.13 (10.92)	0.08 (4.60) **
Women-market labor	-0.07 (-3.30) **		0.05 (3.45)	0.27 (15.52) **
Men-housework	0.71 (13.45) **	0.19 (3.51) **		-0.16 (-3.43) **
Men-market labor	0.12 (4.66) **	0.37 (15.52) **	-0.06 (-3.92)	
Log value of household income	0.30 (0.63)	-1.01 (-2.17) *	0.37 (1.29)	-0.24 (-0.59)
Gwang Yeok Si excluding the Metropolitan area	-0.55 (-0.57)	-2.33 (-2.42) *	0.23 (0.39)	-0.81 (-0.98)
Gangwon region	2.22 (1.05)	-2.20 (-1.05)	-1.32 (-1.02)	-2.63 (-1.45)
Chungcheong region	1.29 (0.94)	-0.67 (-0.49)	0.37 (0.45)	-3.21 (-2.73) **
Jeolla region	-0.46 (-0.32)	-0.93 (-0.64)	1.07 (1.23)	-3.82 (-3.09) **
Gyeongsang region	0.75 (0.55)	-3.02 (-2.22) *	0.72 (0.88)	-1.71 (-1.46)
Jeju/overseas	-2.05 (-0.84)	-0.66 (-0.27)	5.48 (4.00)	-1.44 (-0.69)
Women-25-34 yrs	1.06 (0.49)	-1.06 (-0.49)	0.38 (0.28)	3.29 (1.75)+
Women-35-44 yrs	-0.22 (-0.13)	0.68 (0.41)	1.01 (0.96)	0.93 (0.65)
Women-45-54 yrs	-0.09 (-0.07)	0.44 (0.36)	0.36 (0.44)	-0.28 (-0.26)
Women-High school	2.12 (1.78)+	-3.98 (-3.37) **	-0.49 (-0.65)	-0.31 (-0.31)
Women-Two-year College	0.14 (0.08)	-6.55 (-3.97) **	0.17 (0.16)	-0.02 (-0.02)
Women-Four-year University	2.96 (1.70)+	-10.44 (-6.08) **	-0.38 (-0.36)	1.37 (0.92)
Women-Graduate or higher	7.17 (2.52)+	-13.49 (-4.79) **	-0.39 (-0.23)	-0.71 (-0.29)
Men-25-34 yrs	-2.66 (-1.12)	-0.54 (-0.23)	3.19 (2.25)	-1.50 (-0.74)
Men-35-44 yrs	0.74 (0.47)	-3.34 (-2.12) *	2.35 (2.39)	-0.09 (-0.06)
Men-45-54 yrs	-1.60 (-1.33)	-1.58 (-1.32)	1.68 (2.19)	0.11 (0.10)
Men-High school	-0.59 (-0.53)	1.44 (1.28)	-0.32 (-0.45)	-0.46 (-0.47)
Men-Two-year college	-0.79 (-0.51)	-1.65 (-1.06)	0.56 (0.58)	-0.40 (-0.30)
Men-Four-year university	-0.54 (-0.37)	0.08 (0.05)	-0.80 (-0.89)	-3.76 (-3.01) **
Men-Graduate or higher	-1.83 (-0.78)	-0.70 (-0.30)	0.53 (0.38)	-5.68 (-2.82) **
Log value of the number of household members	5.54 (3.54) **	1.28 (0.82)	-3.08 (-3.14)	1.76 (1.31)

	Women		Men	
	Household labor hours	Market labor hours	Household labor hours	Market labor hours
Infants/toddlers	8.46 (4.89) **	-3.84 (-2.22) *	4.53 (4.56)	1.57 (1.06)
Preschoolers	7.22 (6.66) **	-0.87 (-0.79)	3.88 (6.12)	0.38 (0.40)
Children aged under 18	-0.72 (-0.74)	-0.71 (-0.74)	0.41 (0.69)	2.07 (2.51) *
Living with parents (grandparents)	-0.59 (-0.53)	-0.22 (-0.20)	-1.36 (-1.91)	0.43 (0.46)
Home ownership	-0.46 (-0.62)	-2.22 (-2.99) **	-0.20 (-0.44)	-0.74 (-1.16)
Women-Log value of income	-3.47 (-5.26) **	13.87 (23.45) **	1.12 (2.79)	-3.23 (-5.72) **
Women-Management/specialized area	-1.12 (-0.82)	-3.47 (-2.56) **	2.67 (3.26)	-0.02 (-0.01)
Women-Clerical/service	-0.83 (-0.78)	3.76 (3.58) **	1.44 (2.21)	-0.82 (-0.90)
Women-Manufacturing	-1.43 (-1.18)	3.66 (3.04) **	0.17 (0.23)	-0.71 (-0.69)
Women-Part-time	0.87 (0.99)	-0.22 (-0.25)	0.27 (0.51)	-0.88 (-1.17)
Men-Log value of income	0.56 (0.88)	-1.63 (-2.61) **	-0.34 (-0.87)	3.64 (6.82) **
Men-Management/specialized area	2.02 (1.66)+	3.86 (3.19) **	-0.91 (-1.20)	0.06 (0.06)
Men-Clerical/service	1.31 (1.42)	0.31 (0.34)	-0.38 (-0.68)	-1.55 (-1.96) *
Men-Manufacturing	0.13 (0.15)	0.69 (0.80)	-0.95 (-1.81)	2.43 (3.27) **
_Sigma	14.44 (65.96) **	14.37 (66.27) **	8.07 (47.80)	12.37 (66.27) **
-log L	8,944	8,969	5,116	8,639

Note: The figures in bracket are t values. \*\* refers to 1% significance level; \* 5% significance level; and + 10% significance level.

Husbands' housework hours (third column) appear to be heavily affected by the presence of young children. However, when there are other members in the household, such as cases where the number of household members is larger or when they are living with their or their spouse's parents, husbands are able to significantly reduce their housework burden. By age group, younger husbands spend more time on housework. While women's housework hours are not significantly affected by their spouse's income, men's housework hours increase and market work hours decline as their wife's income increases.

Men's market work hours (fourth column) seems to be closely related to education and to the nature of their work. There is a positive relationship with their personal income, but a negative relationship with education, as was the case with women.



Table 6 is a summary of the results of estimation of equations (1) after acquiring fitted values of used time by means of the estimated values of reduced equations. The full results of estimation are included in the appendix.

The results of estimation from a model taking into account the interdependence of couples' time allocation decisions differ notably from the results of reduced equations. In the case of women in particular, the substitute effect between market labor and household labor was greatly reduced. While the negative effect of market labor hours on domestic labor hours remains, the negative effect of domestic labor hours on market labor hours disappears. Furthermore, the male partner's time allocation has a minimal impact. The only statistically significant finding is the negative relationship between women's market work and their spouse's housework. These results, which are highly similar to the results of a study by Connelly and Kimmel (2007), imply that a husband's time allocation does not much impact women's time allocation decisions.

Unlike women, however, men were greatly affected by their wife's time allocation. The degree of influence turned out to be much more greatly amplified than had been identified through reduced equations. Men's hours of housework grew together with an increase in their wife's housework hours and their market labor hours went up along with an increase in their wife's market labor hours. When viewed from the traditional perspective of a choice between housework and market labor, this change fails to demonstrate a consistent characteristic. One possible explanation is that both housework hours and market labor hours may be in a competitive relationship with the hours of some third activity. This puzzle can be easily resolved if the effect is dominant compared to the substitute relationship of market labor and domestic labor. One example is leisure activity hours. As explained in previous studies by both international researchers and Ji-mi Seong (2006), couples' leisure activity hours are in a complementary relationship since they engage in leisure activities together.

Table 6. Results of estimation of structural equation (summary)

		Household labor hours		Market labor hours	
		Women	Men	Women	Men
Household labor hours	Women		0.464 (25.51)	0.064 (0.81)	0.489 (6.90)
	Men	-0.306 (-0.17)		-0.398 (-2.10)	-1.037 (-6.18)
Market labor hours	Women	-0.259 (-2.81)	0.178 (17.34)		0.197 (6.20)
	Men	0.074 (0.43)	-0.136 (-4.50)	-0.008 (-0.13)	

## V. Conclusion

There is a growing trend in South Korea for women to spend less time on household labor as their spouse's participation in housework increases. This research has attempted to identify whether couples' time allocation decisions are affected by interactions between a husband and wife to the point that consistent rules and directions of changes can be identified. One of the potential directions for evolution that can easily be presumed is that as more women become involved in market labor, a portion of their traditional housework burden becomes shared with their husbands, resulting in women's housework hours and men's time allocation drifting in opposite directions.

However, the results of this empirical analysis failed to satisfy this prediction. No competition was found between husband and wife regarding household labor. Rather, when the amount of housework necessary increased, both husband and wife dedicated more time to it. It is assumed that the types of housework that require such an increase in time from both spouses is care work mainly related to childrearing. In fact, it is difficult for men to engage in care work in place of women outside of a certain range. Hence, it is likely that a significant fraction of the care work burden is substituted by marketization rather than by being transferred to men. The same holds true for other types of household labor. In this regard, the substitutability between men's and women's housework hours is not particularly great, but complementability is more prominent when care work is required.

This research demonstrates certain limitations in fully analyzing the correlations or interactions that operate in couples' time allocation decisions, which implies that more detailed investigation is required for the dynamics of various interactions to be examined. In particular, this investigation reaffirmed that couples' time allocation cannot be closely examined purely through a simple division of market labor and domestic labor, since it is not possible to reflect the increasing importance of time use components such as care work and leisure activities, which entail highly different characteristics. More recently, using a form of diary is becoming widespread as a research method for investigating time use patterns.

Lastly, this research also includes limitations as a cross-sectional analysis, since allocation of time is intrinsically a matter of preference. Given that it is almost impossible in a cross-sectional analysis to properly control unique characteristics of individuals and households, a more in-depth analysis using panel data is needed in the future.

## References

- Kim, Hyeon-suk (2009), Research on Labor Supply Decisions of South Korean Households, *Journal of Public Finance*, Vol. 2 (2): 1-37. (Korean language)
- Seong, Ji-mi (2006), Determining Factors in Time Allocation of Married Working Women, *Journal of Labor Policy*, Vol. 6 (4): 1-29. (Korean language)
- Yoon, Ja-yeong (2010), Determining Factors in Time Allocation by Mothers, *Korean Journal of Labor Economics*, Vol. 33 (2), 2010. 08: 27-52 (Korean language)
- Alvarez, Begona and Daniel Miles (2003). "Gender Effect on Housework Allocation: Evidence from Spanish Two-Earner Couples," *Journal of Population Economics*, 16: 227-242.
- Becker, Gary S (1965). "A Theory of the Allocation of Time." *The Economic Journal* 75 (299): 493-517.
- Blau, Francine and Laurence Kahn (2005). "Changes in the Labor Supply Behavior of Married Women: 1980-2000," NBER Working Paper No. 11230.
- Blau, Francine D. and Lawrence M. Kahn (2007). Changes in the Labor Supply Behavior of Married Women: 1980.2000, *Journal of Labor Economics*, Vol. 25, No. 3: 393-438
- Bloemen, Hans G., Silvia Pasqua and Elena G. F. Stancanelli (2010). An empirical analysis of the time allocation of Italian couples: are they responsive?, *Review of Economics of the Household*, vol. 8, issue 3: 345-369
- Burda, Michael C. & Daniel S. Hamermesh & Philippe Weil (2006). "The Distribution of Total Work in the EU and US," IZA Discussion Papers 2270.
- Connelly, Rachel & Jean Kimmel (2009). "Spousal influences on parents' non-market time choices," *Review of Economics of the Household*, Springer, vol. 7(4): 361-394.
- Connelly, Rachel and Kimmel, Jean (2007). Spousal Influences on Parents' Non-Market Time Choices, IZA Discussion Paper No. 2894.
- Cragg, J. G. (1971). "Some Statistical Models for Limited Dependent Variables with Application to the Demand for Durable Goods." *Econometrica*, 39 (5), 829-844.

- Graham, John W. and Carole A. Green (1984). "Estimating the Parameters of a Household Production Function with Joint Products," *The Review of Economics and Statistics* Vol. 66, No. 2 (May), pp. 277-282.
- Gronau, Reuben (1977). "Leisure, Home Production, and Work-the Theory of the Allocation of Time Revisited." *Journal of Political Economy* 85: 1099-1123.
- Hersch, J. & Stratton, Leslie, S. (1994). "Housework, Wages and the Division of Household Time for Employed Spouses". *American Economic Review* 84 (2).
- Hersch, Joni and Stratton, Leslie (1993). "Housework, Effort, and Wages of Married Workers." Working paper, University of Arizona.
- Juster, Thomas and Stafford, Frank P. (1991). "The Allocation of Time : Empirical Findings, Behavioral Models, and Problems of Measurement." *Journal of Economic Literature* 29 (2): 471-522.
- Kimmel, Jean and Connelly, Rachel (2007). "Mothers' Time Choices: Caregiving, Leisure, Home Production and Paid Work." *The Journal of Human Resources* 42 (3): 643-681.
- Kooreman, Peter and Kapteyn, Arie (1987). "A Disaggregated Analysis of the Allocation of Time within the Household." *The Journal of Political Economy* 95 (2): 223-249.
- Lundberg, Shelly (1988). "Labor Supply of Husbands and Wives: a Simultaneous Equations Approach," *Review of Economics and Statistics*, 70: 224-235.
- Manser, Marilyn and Murray Brown (1980). "Marriage and Household Decision Making: a Bargaining Analysis." *International Economic Review*, 21: 31-44.
- Nelson, F. and Olson, L. (1978). "Specification and Estimation of a Simultaneous-equation Model with Limited Dependent Variables." *International Economic Review*, 19 (3): 695-709.
- Solberg, Eric J. and Wong, David C. (1992). "Family Time Use : Leisure, Home Production, Market Work, and Work Related Travel." *The Journal of Human Resources* 27 (3): 485-510.

## Appendix. Results of estimation of structural equation

	Women		Men	
	Household labor hours	Market labor hours	Household labor hours	Market labor hours
Constant term	25.87 (7.61) **	-8.05 (-2.84) **	-10.58 (-6.66) **	15.50 (5.12) **
Women-housework		0.06 (0.81)	0.46 (25.51) **	0.49 (6.90) **
Women-market labor	-0.26 (-2.81) **		0.18 (17.34) **	0.20 (6.20) **
Men-housework	-0.31 (-0.17)	-0.40 (-2.10) *		-1.04 (-6.18) **
Men-market labor	0.07 (0.43)	-0.01 (-0.13)	-0.14 (-4.50) **	
Log value of household income	0.35 (0.50)	-1.56 (-10.31) **	0.28 (2.98) **	-0.43 (-2.29) *
Gwang Yeok Si excluding the Metropolitan area	-1.09 (-2.96) **	-3.78 (-10.61) **	0.53 (2.40) *	-1.41 (-3.48) **
Gangwon region	0.71 (0.48)	-4.24 (-4.95) **	-1.12 (-2.35) *	-4.01 (-4.61) **
Chungcheong region	1.01 (1.76) +	-2.33 (-4.20) **	-0.32 (-0.98)	-3.65 (-6.58) **
Jeolla region	-0.03 (-0.03)	-2.56 (-4.62) **	0.65 (1.86) +	-3.58 (-5.87) **
Gyeongsang region	0.92 (0.84)	-4.56 (-8.50) **	0.20 (0.64)	-2.74 (-4.97) **
Jeju/overseas	2.31 (0.24)	1.32 (1.08)	4.94 (9.18) **	3.21 (2.41) *
Women-25-34 yrs	1.30 (1.42)	0.32 (0.40)	-0.38 (-0.77)	3.09 (3.40) **
Women-35-44 yrs	0.71 (0.55)	1.51 (2.59) **	0.37 (1.02)	2.07 (3.15) **
Women-45-54 yrs	0.32 (0.63)	0.51 (1.18)	-0.01 (-0.05)	-0.16 (-0.32)
Women-High school	0.74 (1.61)	-5.48 (-11.62) **	-0.24 (-0.93)	-1.35 (-2.84) **
Women-Two-Year College	-1.89 (-1.07)	-8.92 (-15.67) **	1.93 (5.45) **	0.13 (0.17)
Women-Four-year University	-0.16 (-0.06)	-13.40 (-22.38) **	1.57 (4.42) **	0.34 (0.47)
Women-Graduate or higher	3.67 (0.87)	-18.82 (-17.28) **	0.93 (1.54)	-3.22 (-2.78) **
Men-25-34 yrs	-1.25 (-0.35)	-0.63 (-0.66)	2.79 (5.34) **	0.82 (0.74)
Men-35-44 yrs	1.22 (0.44)	-3.25 (-5.83) **	1.14 (3.35) **	0.68 (1.03)
Men-45-54 yrs	-1.38 (-1.31)	-1.26 (-2.98) **	1.24 (4.77) **	1.31 (2.70) **
Men-High school	-0.55 (-0.83)	0.93 (2.36) *	-0.08 (-0.33)	-0.34 (-0.74)
Men-Two-year College	-0.93 (-0.76)	-2.40 (-4.35) **	1.13 (3.31) **	0.15 (0.23)
Men-Four-year University	-1.83 (-1.32)	-2.90 (-5.20) **	0.05 (0.14)	-3.82 (-6.46) **
Men-Graduate or higher	-2.70 (-1.95) +	-4.12 (-4.76) **	1.93 (3.54) **	-4.06 (-3.90) **
Log value of the number of household members	4.14 (2.52) *		-2.92 (-9.02) **	
Infants/toddlers				

	Women		Men	
	Household labor hours	Market labor hours	Household labor hours	Market labor hours
Preschoolers	14.32 (1.37)			
Children aged under 18	11.20 (1.37)			
Living with parents (grandparents)	-0.39 (-1.02)			
Home ownership	-1.48 (-1.31)		-0.12 (-2.12) *	
Women-Log value of income		14.65 (30.10) **		
Women-Management /specialized area		0.16 (0.60)		
Women-Clerical/service		4.43 (16.88) **		
Women-Manufacturing		4.50 (15.77) **		
Part-time		-0.13 (-0.75)		
Men-Log value of income				3.41 (13.88) **
Men-Management/specialized area				0.49 (2.47) *
Men-Clerical/service				-0.30 (-1.89) +
Men-Manufacturing				2.23 (10.88) **

Note: Figures in bracket are t values. \*\* refers to 1% significance level; \* 5% significance level; and + 10% significance level.