HEALTH STATUS AND THE LABOR FORCE PARTICIPATION DECISIONS OF MARRIED COUPLES

A Thesis

by

PENG LIN

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2008

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Approved by:

Chair of Committee,	Manuelita Ureta
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ABSTRACT

Health Status and the Labor Force Participation Decisions of Married Couples.

(December 2008)

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Chair of Advisory Committee: Dr. Manuelita Ureta

This thesis examines the labor force participation decisions of married couples, and special attention is paid to a spouse's health conditions affecting their own and the spouse's labor force participation decision. I used the Health and Retirement Study survey data and estimated a seemingly unrelated bivariate probit model.

A number of variables besides health condition were added: age, education level, and family unearned income.

The results of this research paper support the findings from the relevant literature that the labor supply decisions of the husband and wife are related. The oldest age group is least likely to work. The younger the husband, the more likely it is that the husband will work. At the ages between 40 and 49, wives have the biggest probability to work. The higher the education level, the more likely it is that a spouse is going to work. The more total family unearned income, the less probable the spouse will go to work. Poor health has a negative effect on labor force participation and a positive effect for the spouse's labor force participation.

ACKNOWLEDGEMENTS

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1. INTRODUCTION

I examine the impact of a spouse's health condition on his or her own labor force participation decision and the spouse's labor force participation decision. I will consider the joint decision making of each couple.

The health condition of family members is likely to affect significantly the labor market decisions made within families. It is fairly reasonable that in a married couple framework, if one spouse doesn't have good health, his or her own labor force participation will be affected, and the other spouse might need to take more time off or to work extra hours to make money in order to pay hospital bills. From an economist's viewpoint, there are four possible family labor force participation outcomes: 1st both husband and wife work, 2nd wife works husband does not, 3rd husband works wife does not, 4th neither of them works.

This research topic sheds light on the effect of health outcomes on middle aged couples in the US. Considering the health condition affecting labor force participation is important because first, a lot of times, people tended to observe the more obvious factors, such as how many children the family has, wage rate, unearned family income, etc. But health condition is sometimes overlooked. Second, couples' labor force participation decisions could be different from an individual's decisions. So explore health factor in a household's framework, will help discovering how couples' labor force participation decisions are made.

This thesis follows the style of Journal of Econometrics.

2. LITERATURE REVIEW

This topic has received attention since the 1970's. There are a significant number of scholars who wrote papers dealing with family labor force participation decisions using different data bases and modeling techniques. In the following paragraphs, I summarize the relevant literature. The existing research can be categorized into two groups: cross-sectional data analysis in earlier research and panel data analysis in recent research.

Parsons (1977)[1] examined what the wife's labor supply decisions look like when husbands become ill. Parsons found little empirical evidence of the husbands' health having an impact on the wives' labor supply. He also paid particular attention to health effects on the joint labor participation of husbands and wives and to the different labor participation responses of married and single men to poor health. Parsons looked at the time allocation of market work and home work of husband and wife and he found that for both husbands and wives, one's own health problems appear to lead to substantial market time withdrawals (about 700 hours and 350 hours, respectively) while home work hours remain unchanged. As one might expect, illness in one's spouse leads to quite different time allocation responses as men increase their home production time, women their market work time. These work time increases appear to come largely from leisure time in both cases.

[1] Parsons, D. O., 1977, Health, family structure, and labor supply, American Economic Review 67, 703-712.

In both the Berger (1983)[2] and Berger and Fleisher (1984)[3]'s papers, they report that a husband's disability has a positive effect on the wife's labor force participation and working hours. While Berger (1983) found negative effects of a wife's disability on the labor force participation and hours worked of the husband.

Berger and Fleisher (1984) examined the labor supply response by the wife over time to deterioration in the husband's health. Unlike previous studies using cross sectional data, longitudinal data were used which allows responses over time to be examined directly. They report that transfer income after the husband's deterioration of health has an important effect over the decision of the wife's labor force participation. As available payments increase relative to the husband's pre-disability market wage, the wife eventually decreases instead of increasing her market work. When this happens, the net loss in family income is small enough to be outweighed by the increase in the husband's need for care at home, thus causing the wife to reduce her labor market activities. When transfer payments replaced enough of the lost earnings of the husband, the wife was able to reduce her market work in order to care for the husband at home. In recent years, more research has been done using panel data. Using the Retirement History Survey, and fitting a multivariate probit model, Blau (1998)[4] used panel data for the cohort of individuals aged 55 and over from 1969 to 1979 to estimate the labor force dynamics of older couples. By examining the movement among the four employment

[2] Berger, M. C., 1983, Labor supply and spouse's health: the effects of illness, disability, and mortality, Social Science Quarterly 64, 494-509.

[3] Berger, M. C. and B. M, Fleisher, 1984, Husband's health and wife's labor Supply, Journal of Health Economics 3, 63-75.

[4] Blau, D. M, 1998, Labor force dynamics of older married couples, Journal of Labor Economics 16, 595-629.

states (both employed, husband only employed, wife only employed, or neither employed), Blau (1998) found poor health of a given spouse had large negative effects on the individual's labor market entry rate and large positive effects on the individual's labor market exit rate. And the own health effect was larger for husbands than for wives. In addition, Blau argued that the health insurance provided by the wife's employer might be important to the couple, given the employment status of the couple.

Following Blau 1998, Blau and Riphahn (1999)[5], using the German Socio-Economic Panel, fitted a competing risk hazard model to capture the labor force transitions in discrete time of married couples with at least one spouse in the age range of 50-69 in Germany. They included economic variables, education and household characteristics, and health as explanatory variables. For health variables, they found that wives were less likely to exit the labor force and more likely to enter the labor force if the husband had a chronic condition and was still working, and were more likely to exit and less likely to enter if the husband had left the labor force. The same pattern does not hold for men. Husbands were less likely to stop employment and less likely to reenter employment if the wife had a health condition, a response that was independent of the wife's labor force status.

In the 2000's, there are 2 papers on family labor supply decisions, using the Health and Retirement Survey data.

[5] Blau, D. M. and R. T. Riphahn, 1999, Labor force transitions of older married couples in Germany, Labour Economics 6, 229-251.

In 2003, Pienta[6] used the first two waves of the HRS data, and fitted a multinomial logit model in order to capture the labor force transitions of married men and women. She finds that married individuals were less likely to be observed as retired if their spouse reported a disability than if the spouse were not disabled. However, because she modeled husbands and wives separately, some commentators have argued that this modeling strategy could not completely characterize the labor force choices facing a family.

In 2004, Berger and Pelkowski[7] used joint modeling, and pointed out that if both spouses were working and one spouse experienced a health problem, the other spouse was likely to remain working while the spouse with the health problem was likely to drop out of the labor force. If neither was working and one spouse experienced a health problem, the other spouse was unlikely to return to work.

[6] Pienta, A.M., 2003, Partners in marriage: an analysis of husbands' and wives' retirement behavior, Journal of Applied Gerontology 22, 340-358.

[7] Berger, Mark C. and J.M. Pelkowski, 2004, Health and family labor force transitions, Quarterly Journal of Business & Economics 42, 113-138.

3. THEORETICAL FRAMEWORK

3.1 Labor-Leisure Choice Model

3.1.1 Work and Leisure

The decision to work is ultimately a decision about how to spend time. In the labor-leisure choice model, economists simplify the problem by focusing on the allocation of time to either leisure or work. Leisure is pleasurable leisure activities generating well-being. Work refers to work for pay in the labor market. Work around the home for household production is typically treated as leisure time.

3.1.2 Utility Curves and Budget Constraints

Depending on the opportunity cost of leisure, a person's wealth level, and preferences, one can allocate time in different combinations of work and leisure, while maintaining the same level of satisfaction. That is, the utility level stays the same. Different shapes of the indifference curves depict people's preference differences. People will be happy to have as high a utility level as possible. In Figure 1, utility level B is higher than utility level A', and utility level A' is higher than utility level A.

Economists believe that resources that anyone can command are limited. Each person is facing a budget constraint, which defines the highest and the lowest income a person can earn, giving different working hours.

In Figure 1, any work-leisure combination within the southwest and along the budget constraint is obtainable, while any point beyond northeast of the budget

constraint is unobtainable. A person seeking the highest obtainable utility level will choose point N as the best work-leisure combination.[8]

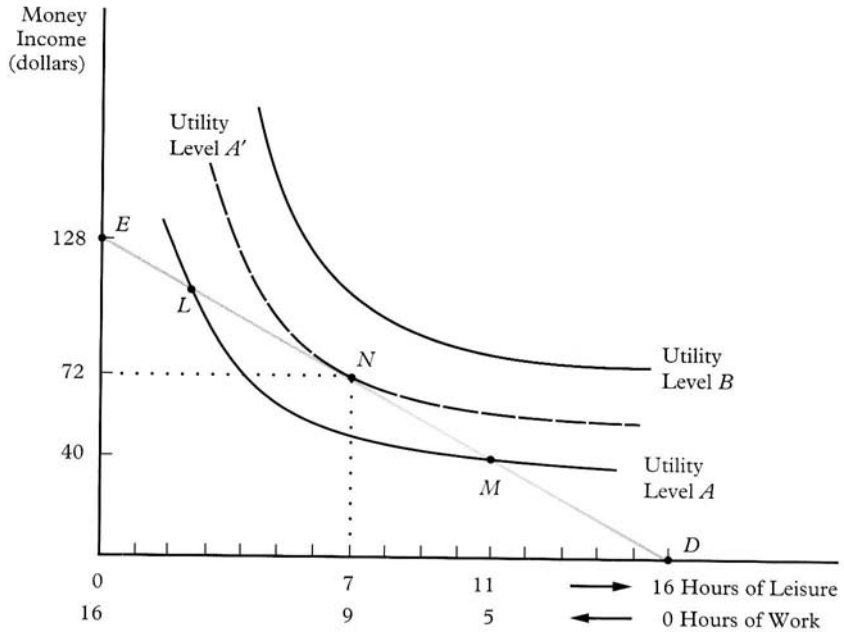

Figure 1 Indifference Curves and Budget Constraint[9]

3.1.3 Labor Force Participation Decision

The analysis above assumed that people work at least some hours. However, there are some people who don't work at all.

As illustrated in Figure 2 some people will have utility curves so steep (that is, preferences for leisure so strong) that there is no point of tangency with ED. For these

[8] Enrenberg R.G. and R.S. Smith, 2005, Modern labor economics: Theory and public policy, (New York: Pearson Addison Wesley) 178-179.

[9] Enrenberg R.G. and R.S. Smith, 2005, Modern labor economics: Theory and public policy, (New York: Pearson Addison Wesley) 179.

people, utility is maximized at the "corner" (point D). They desire no work at all and therefore are not in the labor force.

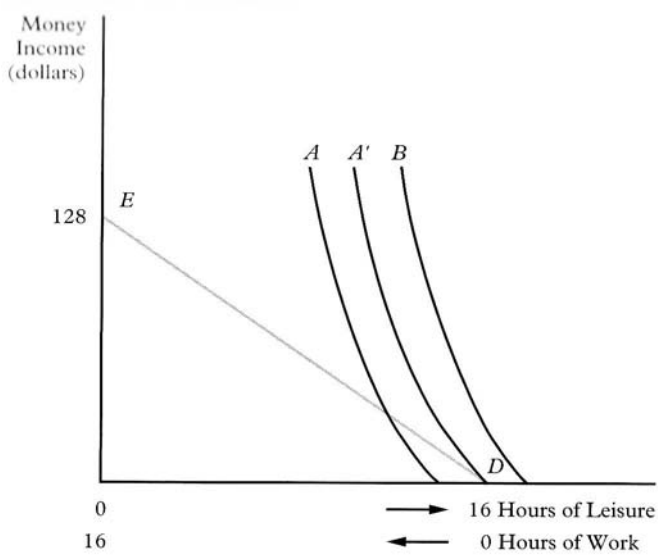

Figure 2 The Decision Not to Work Is a "Corner Solution"[10]

An implication of the labor-leisure model is that if people who are not in the labor force place a value of X on the marginal hour of leisure greater than the market wage rate. Because they will "reserve" their labor unless the wage is X or more, economists say that they have a reservation wage of X. The reservation wage, then, is the wage below which a person will not work, and in the labor/leisure context it represents the value placed on an hour of lost leisure time.

[10] Enrenberg R.G. and R.S. Smith, 2005, Modern labor economics: Theory and public policy, (New York : Pearson Addison Wesley) 181.

Refer back to Figure 2 the reason that person remained out of the labor force was because the wage was everywhere lower than her or his marginal value of leisure time.

3.2 Joint Decision within the Household

For those who live with a spouse, some kind of joint decision-making process must be used to allocate the time of each spouse and to agree on who does what in the household. Noticed here, we extract the household production time from working time. So every household is facing a tripartite choice: market work, household work, and leisure.

Economic theory suggests the following decisions that all households must make.

First, find the specialization of function for each spouse. An individual's productivity differs at home and at work. By letting the person who has a higher wage rate work longer hours, and the person who is more productive at home do more household work, the whole family is better off. Thus, decisions about household labor force participation must be made in full consideration of the market and household productivity of both partners.

Second, take a look at changes in the behavior of one spouse. Consider if one spouse decides to participate in the labor force, the other spouse's reaction may go in two opposite directions, called cross-effect. If the two spouses are substitute in the household production of commodities, then the other spouse will decrease the hours worked or in an extreme case, drop out of the labor force in order to substitute the chores that the other spouse used to perform. If they are complementary in the consumption of household commodities, then the other spouse will increase hours worked or start to

participate in the labor market as well. Again, theory cannot predict whether the spouses are substitutes or complements in household production and consumption. Similarly, it is impossible to say which cross-effect will dominate if their signs conflict. There is yet no real consensus on the sizes and signs of these cross-effects for husbands and wives.

Third, deal with the situation where one spouse is forced out of market work. The spouse who lost a job while still actively looking for one is considered as unemployed. The other spouse has two possible responses: on one hand, is to increase the labor supply or to participate in the labor force in order to maintain the family income. On the other hand, the limited resource, such as the limited job openings, the skills sets of a job seeker, might force the spouse to remain or reduce her or his market labor supply level or continue to stay at home.

4. ESTIMATION STRATEGY

The econometric model that I use is the Seemingly Unrelated Bivariate Probit. The reason for using this model is the nature of the research question.

First, the model has to be based on probit, because I am modeling binary responses. The dependent variable is whether a married person is going to participate in the labor force or not. Using the latent variable model, letting y^* be an unobserved, or latent variable, determined by $y^* = \beta_0 + \mathbf{x}\beta + e$, $y = 1[y^* > 1]$. The notation 1[.] is to define a binary outcome. The function y=1[.] is called the indicator function, which takes on the value one if the event in brackets is true, and zero otherwise. Therefore, y is one if $y^* > 0$, and y is zero if $y^* < 0$. The **x** is a set of variables in the estimation. I assume that e is independent of **x** and that e either has the standard logistic distribution or the standard normal distribution. In either case, e is symmetrically distributed about zero. Economists tend to favor the normality assumption for e, which is why the probit model is more popular than logit model in econometrics.[11]

Second, I choose a bivariate model, because there are two probit equations to be modeled, the one for the wife and the other for the husband, and their disturbances (error terms) are correlated. The couples' decision of joining the labor force depends on one another, and they could not be estimated separately.

The general specification for a two-equation model is:[12]

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[11] Wooldridge J. M., 2003, Introductory econometrics, (Australia ; Cincinnati, Ohio : South-Western College Publishing) 616-635.

[12] Greene W.H., 2008, Econometric Analysis, (Upper Saddle River, N.J.: Pearson/Prentice Hall) 817.

$y_1^* = X_1 * \beta_1 + e_1,\ y_1 = 1\ [y_1^* > 0]$ (4.1)

$y_2^* = X_2 * \beta_2 + e_2,\ y_2 = 1\ [y_2^* > 0]$ (4.2)

$E[e_1 | X_1, X_2] = E[e_2 | X_1, X_2] = 0$ (4.3)

$var[e_1 | X_1, X_2] = var[e_2 | X_1, X_2] = 1$ (4.4)

$Cov[e_1, e_2 | X_1, X_2] = rho$ (4.5)

In equation (4.1) and (4.2), y_1^* and y_2^* are defined using the latent variable model that satisfies the classical linear model assumptions: Linear in Parameters, Random Sampling, Zero Conditional Mean, Sample Variation in the independent variable, Homoskedasticity, and Serial Independence.

The y_i is one if $y_i^* > 0$, and *y* is zero if $y_i^* = 0$, where i=1 or 2.

The X_1 and X_2 are used to denote the full set of explanatory variables, such as (X_{i1}, X_{i2}, X_{i3},…, X_{ik}), where i=1 or 2.

The β_1 and β_2 are sets of coefficients for X_1 and X_2.

The e_i are independent from x, and have standard normal distribution, given both X_1 and X_2, which in mathematical form is written as equations (4.3) and (4.4).

The equation (4.5) denotes that the disturbances of equation (4.1) and (4.2) are correlated, given both X_1 and X_2, with a correlation coefficient p. In STATA, rho is calculated indirectly from "athrho". The relationship between "rho" and "athrho" is expressed in the equation below:

$athrho = (1/2) * \{\ln[(1 + rho)/(1 - rho)]\}$ (4.6)

Third, I use seemingly unrelated bivariate probit model because it allows different independent variables to be put as estimation variables in the equations. For

example, the wife's age appears only in her equation, because husband's labor force participation is not quite related with his wife's age. Their ages have a significant influence on their own labor force participation decisions. However, the health levels of both spouses are included into both equations, since I am hoping to find that a spouse's health condition will influence the other spouse's labor force participation decision.

5. DATA DESCRIPTION

5.1 Data Description

I use the Health and Retirement Study survey data. The targeted respondents of the HRS[13] are the non-institutionalized men and women born between 1931 and 1941 residing in the United States. Partners of the original targeted sample are also interviewed, even if not initially age eligible. There are altogether 7 waves of data, containing 7 different times of interviews.

I chose the first wave of the data, whose interviews were carried out in 1992-1993. I chose wave 1 instead of wave 2 or wave 3 is because in the first wave, interviewers asked "does your health affect or limit any work?". This question generated a very important variable in measuring the health condition "whether health limits work", which I used as the health condition variable in the research of this paper. But they did not ask this question again in the second and the third wave. Second, I choose wave 1, instead of wave 4 or the waves after, is because the interviews in wave 4 are carried out in 1998, which is 5 years later after the interviews of the first wave.[14] By the time, the average interviewee's age was around 60 or over. And the age distribution in the waves after the fourth wave is even older. So I believe that the average age of the observations in the first wave is younger and more suitable for the specific research topic than other waves.

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[13] The HRS (Health and Retirement Study) is sponsored by the National Institute of Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan.

[14] Clair, P. and D. Blake, 2007, RAND HRS Data Documentation, Retrieved April 8, 2008, from http://hrsonline.isr.umich.edu/meta/rand/randhrsg/randhrsg.pdf 13, 261.

I modified the data as follows: I kept the data for married couples, with both spouse present. I dropped the data for couples when either of them is above the age of 62.

5.2 Description of Variables

5.2.1 Dependent Variable

The dependent variable is an indicator for labor force status. It is equal to 1 if the person is working for pay or unemployed. It is equal to 0 if an individual is partly retired, retired, disabled, or not in labor force. The label for wife is "**wifework**". The label for husband is "**husbandwork**".

5.2.2 Independent Variables

5.2.2.1 Demographic Information

The reasons of including age are the following. People's labor force participation decisions differ in different age groups. At young ages, individuals tend to stay in school. Middle people tend to participate in the labor force. In the later age period, people tend to retire.

The ages of wives and husbands are grouped into 4 categories. For each category, there is a corresponding dummy variable.

I define a binary variable "**w_age1**" to equal to one if a wife's age is between 23 and 39, and zero otherwise. Similarly, "**h_age1**" is defined to equal to one if a husband's age is between 23 and 39, and zero otherwise. The "**w_age 2**" is defined to equal to one if a wife's age is between 40 and 49, and zero otherwise. The "**h_age 2**" is defined to equal to one if a husband's age is between 40 and 49, and zero otherwise. The "**w_age3**"

is defined to equal to one if a wife's age is between 50 and 55 and zero otherwise. The "**h_age 3**" is defined to equal to one if a husband's age is between 50 and 55, and zero otherwise. The "**w_age4**" is defined to equal to one if a wife's age is between 56 and 62, and zero otherwise. The "**h_age 4**" is defined to equal to one if a husband's age is between 56 and 62, and zero otherwise.

The category of age between 56 and 62 is assigned as the reference group.

5.2.2.2 Human Capital and Education Variables

The reason I include people's education level into the estimation is because people's labor force participation decisions differ across different education levels. For example, my aunt who is an elementary school graduate has never worked in her whole life. My grandpa, a college graduate, didn't retire until he was 80.

The education levels of husbands and wives are grouped into 5 categories. For each category, there is a corresponding dummy variable.

I define a binary variable "**w_eduLThighschool**" to equal one if a wife's education level is less than high school, and zero otherwise. Similarly, "**h_eduLThighschool**" is defined to equal one if a husband's education level is less than high school, and zero otherwise. The "**w_eduGED**" is defined to equal one if a wife is GED[15] holder, and zero otherwise. The "**h_eduGED**" is defined to equal one if a husband's education level is recognized as GED holder, and zero otherwise.

[15] GED is the acronym for General Educational Development. A certificate awarded to a person who successfully passes exams measuring their educational level. The GED certificate is equivalent to a high school diploma. But in this paper, GED is considered as an education level higher than less than high school, but lower than high school graduates level.

The "**w_eduHSgraduate**" is defined to equal one if a wife is a high school graduate, and zero otherwise. The "**h_eduHSgraduate**" is defined to equal one if a husband is a high school graduate, and zero otherwise. The "**w_eduLC**" is defined to equal one if a wife has some college education, and zero otherwise. The "**h_eduLC**" is defined to equal one if a husband has some college education, and zero otherwise. The "**w_eduC**" is defined to equal one if a wife graduated from college, and zero otherwise. The "**h_eduC**" is defined to equal one if a husband graduated from college, and zero otherwise.
The most frequent education level in the sample is high school graduate (wives 38.79%, husbands 29.96%), so high school graduates are chosen to be the reference group.

5.2.2.3 Couples' Financial Situation

I also include Non-labor income in the probit equations, because if one's family is richer, holding other factors constant, the probability for that person to participate into the labor force is lower than the person whose family is poorer. From the household's perspective, if a person's spouse earns more income, this will make that person less likely to participate in the labor force.

I constructed the variable, "household unearned income", defined as "total household income" minus the sum of "wife's income" and "husband's income", if applicable. The natural logs of the (income+1) are taken, in order to avoid generating missing variables, since family income could be zero. I use the natural log of the household unearned income instead of the dollar amount because using a transformation,

especially taking the log, yields a distribution that is closer to normal. [16]This variable is labeled as "lnhh_unearnedincome".

5.2.2.4 Couples' Health

There are various ways of measuring health in the HRS data. I choose to use "whether health limits work" to measure whether health conditions limit participating in the labor force or not. If health conditions limit work, then "whether health limits work" takes the value one, otherwise, takes the value zero. For wives, this variable is labeled as " **w_healthlimitwork**". For husbands, this variable is labeled as "**h_healthlimitwork**".

[16] Wooldridge J. M., 2003, Introductory econometrics, (Australia ; Cincinnati, Ohio : South-Western College Publishing) 114.

6. RESULTS

6.1 Summary Statistics of Variables Used in Analysis

Table 1 lists the variables used in the analysis. Among all the variables, the "unearned household income" is the only continuous variable. The other variables are indicator variables, which take the value of 0 or 1. 60.5% of wives and 78.6% of husbands reported that they were working or unemployed during the survey period. There are very few husbands (0.23%) of age 23 to 39, while the wives' proportion is relatively larger (2.67%). The largest age group for wives is from 50 to 55. The largest age group for the husband is from 56 to 62.

Regarding education level, the largest group is high school graduates for both wives (38.8%) and husbands (29.9%). For wives, the second largest group is less than high school (21.05%), third largest is less than college (20.7%), the fourth is college graduate (14.91%). For husbands, the second largest group is less than high school (23.98%), third largest is college graduate (21.27%), and the fourth is less than college (19.11%).

Regarding health, 16.99% of wives and 19.06% of husbands reported their health limits them from going to work.

Table 1
Summary Statistics of Variables Used in Analysis

Variable	Obs	Mean	Std. Dev.	Min	Max	number of people
husbandwork	7790			0	1	6123.993987
wifework	7790			0	1	4712.530898
h_age1	7790			0	1	17.967635
w_age1	7790			0	1	207.62687
h_age2	7790			0	1	233.580034
w_age2	7790			0	1	1912.562629
h_age3	7790			0	1	3572.57969
w_age3	7790			0	1	3523.667059
h_age4	7790			0	1	3965.872641
w_age4	7790			0	1	2146.142663
lnhh_unearnedincome	7790	6.278105	4.101887	0	13.80849	
h_healthlimitwork	7790			0	1	1484.856574
w_healthlimitwork	7790			0	1	1323.640966
h_eduLThighschool	7790			0	1	1870.638407
w_eduLThighschool	7790			0	1	1641.050748
h_eduGED	7790			0	1	443.203481
w_eduGED	7790			0	1	346.377676
h_eduHSgraduate	7790			0	1	2329.812946
w_eduHSgraduate	7790			0	1	3022.568298
h_eduLC	7790			0	1	1490.321259
w_eduLC	7790			0	1	1618.09206
h_eduC	7790			0	1	1656.023907
w_eduC	7790			0	1	1161.911997

6.2 Presentation and Discussion of the Estimates

General equation:

$$P(y=1|\mathbf{x})= \Phi\ (\beta_0 + \beta_1 X_1 + \ \ldots\ + \beta_9 X_9 + e)= \Phi(\beta_0 + \mathbf{x}\ \boldsymbol{\beta} + e)$$

On the left hand side of the equation, P denotes a probability taking values strictly between zero and one.

On the right hand side of the equation, Φ denotes a normal distribution function. B_0 is the constant term. **x** is a set of explanatory variables, including age, education levels, total unearned income, and a person and the spouse's health. The husband's set is slight different from the wife's set. **β** represents the coefficient set.

Listed in Table 2, from the seemingly unrelated bivariate probit model estimation, the estimated rho[17] is 0.17903, with a standard error of 0.02374 this result implies that the error terms of two estimated equations are significantly, positively related. This also signifies that the seemingly unrelated bivariate probit model fitting method is an appropriate. Because if the rho is insignificant, then the husband and the wife's labor force participation decision is not jointly made. The significantly positive rho also indicates that if other variables not included in the estimation, such as workaholic, or like to play instead of work, tend to be correlated. That is, both spouses tend to be workaholic together. From a long term point, husbands and wives, tended to plan their retirements together.

The age coefficients are all positive. This implies relative to reference group (age from 56 to 62), the probabilities for the other age groups to be in the labor force are higher.

Listed in Table 3 and Table 4, from the marginal effects' view point, if a wife's age is between 50 and 55, compared to the reference group the estimated probability that she participates in the labor force will increase by 0.09158, which is the biggest increase among all age group. Since the coefficient for husband's age between 23 and 39 is very insignificant, combine the age group 1 and 2 for husband is suggested.

Relative to the reference group, high school graduates, the patterns of the other education levels of wives and husbands are different.

For wives, only the less than high school group has a negative coefficient, -0.3653, that is, if a female's education falls in this group, the probability for her

[17] For method of calculating rho, please see page 20, or equation (4.6).

participating in the labor force is smaller than the reference group. The marginal effects table shows that the estimated probability decreases by 0.1426 from the reference group's probability.

However, the other education groups all have positive coefficients compared to reference group, β (w_eduGED)=0.33707, β (w_eduLC)=0.16846, β (w_eduC)=0.3476, that is, if a wife's education falls into one of these 3 education levels, the probability for her to participate into the laborforce is higher than if she is a high school graduate. And the marginal effects table shows that the estimated probability increases compared with the reference group are 0.1216, 0.06346 and 0.12704, corresponding to each age group. Notice here, the GED and the college graduates have higher effect on the wife's decision of participate in the labor force.

For husbands, if the education level is lower than the high school graduates, with coefficients of β (h_edu LTHighschool)= -0.1608 and β (h_eduGED= -0.112, this indicates that the probability of him participating in the labor force is smaller than the reference group, by 0.0389 and 0.0026. If the education level is higher than the high school graduates, with coefficients of β (h_eduLC)=0.10861 and β (h_eduC)=0.13732, this indicates that the probability of him participating in the labor force is bigger than the reference group, by 0.02433 and 0.03057.

The negative coefficients for the total household income are -0.1116 and -0.0295. These results indicate that the increase of total unearned household income will cause the probability of household's participation in the labor market going down. Thus if total unearned household income increases by 10%, probability of wives participate in the

labor force is predicted to decrease by (0.1116 /100)*(10)=0.01116; probability of husbands participate in the labor force is predicted to decrease by (0.0295/100)*(10)=0.00295.

The coefficient of w_healthlimitwork is -0.8198 in wife's equation. The coefficient of h_healthlimitwork is -1.3512 in husband's equation. These two negative numbers mean if a person has a health problem that limits work, then the probability for her or him going to work will be lower than the person who doesn't have a health problem that limit work. In fact, the estimated probability decrease for "unhealthy" wives compared with the "healthier" wives is 0.3181. The estimated probability decrease for "unhealthy" husbands compared with the "healthier" husbands is 0.4239.

The positive coefficients, h_healthlimitwork, 0.03172, in wife's equation, and w_healthlimitwork, 0.02569, in husband's equation mean that if a person's spouse has a health problem that limits work, the person's probability of participating in the labor force will be higher than the person who doesn't have a spouse who has a health problem that limits work. The estimated probability increase is 0.01211 for wives who don't have a healthy husband and 0.00591 for husbands who don't have a healthy wife, compared to the reference status, which is having a "healthy" spouse. But the coefficients are not significant.

Table 2

Summary of Estimate Results

Seemingly unrelated bivariate probit Number of obs = 7790

Wald chi2(20) = 2575.88

Log likelihood = -7629.0225 Prob > chi2 = 0.0000

	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
wifework						
h_healthlimitwork	0.0317246	0.0391053	0.81	0.42	-0.04492	0.1083696
w_healthlimitwork	-0.819765	0.04054	-20.22	0.00	-0.899222	-0.740308
w_age1	0.2071076	0.0954198	2.17	0.03	0.0200882	0.3941271
w_age2	0.5638391	0.0426972	13.21	0.00	0.4801541	0.6475241
w_age3	0.2405197	0.0357078	6.74	0.00	0.1705336	0.3105057
w_eduLThighschool	-0.365292	0.0401899	-9.09	0.00	-0.444062	-0.286521
w_eduGED	0.3370711	0.0768884	4.38	0.00	0.1863726	0.4877697
w_eduLC	0.1684607	0.0408283	4.13	0.00	0.0884387	0.2484827
w_eduC	0.3476026	0.0474794	7.32	0.00	0.2545447	0.4406604
lnhh_unearnedincom	-0.029509	0.0038078	-7.75	0.00	-0.036973	-0.022046
_cons	0.327423	0.0424836	7.71	0.00	0.2441567	0.4106893
husbandwork						
h_healthlimitwork	-1.351227	0.0415739	-32.5	0.00	-1.43271	-1.269744
w_healthlimitwork	0.0256907	0.0488163	0.53	0.60	-0.069988	0.1213689
h_age1	6.985201	21783.93	0	1.00	-42688.74	42702.71
h_age2	0.8900233	0.1426226	6.24	0.00	0.6104882	1.169558
h_age3	0.4790318	0.0386924	12.38	0.00	0.4031961	0.5548675
h_eduLThighschool	-0.160771	0.0501883	-3.2	0.00	-0.259139	-0.062404
h_eduGED	-0.011168	0.0824691	-0.14	0.89	-0.172804	0.1504688
h_eduLC	0.1086094	0.054904	1.98	0.05	0.0009994	0.2162193
h_eduC	0.1373186	0.0528408	2.6	0.01	0.0337524	0.2408847
lnhh_unearnedincom	-0.111567	0.0054468	-20.48	0.00	-0.122242	-0.100891
_cons	1.721623	0.0567281	30.35	0.00	1.610438	1.832808
/athrho	0.1809756	0.0245304	7.38	0	0.1328969	0.2290542
rho	0.1790253	0.0237442			0.13212	0.2251307

Likelihood-ratio test of rho=0: chi2(1) = 54.8814 Prob > chi2 = 0.0000

Table 3

Marginal Effects for Wife's Equation

Marginal effects after biprobit
y = Pr(wifework=1) (predict, pmarg2)
= .61277636

variable	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]	X
h_healthlimitwork*	0.01211	0.01489	0.81	0.416	-0.0171	0.04129	0.19076
w_healthlimitwork*	-0.3181	0.01494	-21.3	0	-0.3473	-0.2888	0.17009
w_age1*	0.07662	0.03387	2.26	0.024	0.01024	0.143	0.0267
w_age2*	0.2029	0.01411	14.38	0	0.17525	0.23055	0.24596
w_age3*	0.09158	0.01349	6.79	0	0.06514	0.11802	0.45186
w_eduLThighschool*	-0.1426	0.01582	-9.01	0	-0.1736	-0.1116	0.21053
w_eduGED*	0.1216	0.02567	4.74	0	0.07129	0.17191	0.04454
w_eduLC*	0.06346	0.01509	4.2	0	0.03388	0.09304	0.20783
w_eduC*	0.12704	0.01634	7.78	0	0.09502	0.15906	0.14917
lnhh_unearnedincome	-0.0113	0.00146	-7.75	0	-0.0142	-0.0084	6.28083

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Table 4

Marginal Effects for Husband's Equation

Marginal effects after biprobit
y = Pr(husbandwork=1) (predict, pmarg1)
= .85104848

variable	dy/dx	Std. Err.	z	P>|z|	[95%	C.I.]	X
h_healthlimitwork*	-0.4239	11.413	-0.04	0.97	-22.792	21.9445	0.19076
w_healthlimitwork*	0.00591	0.31233	0.02	0.985	-0.6063	0.61807	0.17009
h_age1*	0.15273	0.00488	31.3	0	0.14317	0.16229	0.00231
h_age2*	0.1268	8.73031	0.01	0.988	-16.984	17.2379	0.03004
h_age3*	0.10901	5.70999	0.02	0.985	-11.082	11.3004	0.45879
h_eduLThighschool*	-0.0389	1.95396	-0.02	0.984	-3.8686	3.79075	0.2398
h_eduGED*	-0.0026	0.13721	-0.02	0.985	-0.2715	0.26633	0.05674
h_eduLC*	0.02433	1.31454	0.02	0.985	-2.5521	2.60077	0.19114
h_eduC*	0.03057	1.65963	0.02	0.985	-3.2223	3.28339	0.21271
lnhh_unearnedincome	-0.0259	1.3566	-0.02	0.985	-2.6848	2.633	6.28083

(*) dy/dx is for discrete change of dummy variable from 0 to 1

7. CONCLUSIONS

In the family framework, decisions of both spouses are jointly made, especially the participation decision. They behave in a way that works best for their family, and when health problem enters the family, they tend to look after each other, such as work more hours and let the other spouse has more time at home, etc. This agrees with the findings of the relevant literature.

There are similar trends for both spouses. First, if an individual's spouse's has a poor health condition, the likelihood of that participating in the labor force is lower. This is the same as most of the relevant literature. The other spouse will be more possible to participate. This is the same as Blau (1998) and Pienta 2003's results. Others found that when husband can't work the wife will stay home more. Second, the age group of 56-62 has the lowest labor force participation rate. Third, if an individual's spouse has a higher education level, the likelihood of that individual participating in the labor force is higher. Fourth, the increase of total unearned household income will cause the probability of household's participation in the labor market going down.

There are also some differences between spouses. First, there is an age difference. Wives' highest probability of participating into the labor force happens when they are between 40 and 49. Husbands tend to participate less as they get older. Second, wives' holding GED or a college degree, are more likely to participate. Instead, the higher is the education level, the more likely it is that the husband will participate.

REFERENCES

Berger, M. C., 1983, Labor supply and spouse's health: The effects of illness, disability, and mortality, Social Science Quarterly 64, 494-509.

Berger, M. C. and B. M, Fleisher, 1984, Husband's health and wife's labor supply,Journal of Health Economics 3, 63-75.

Berger, M. C. and J.M. Pelkowski, 2004, Health and family labor force transitions, Quarterly Journal of Business & Economics 42, 113-138.

Blau, D. M, 1998, Labor force dynamics of older married couples, Journal of Labor Economics 16, 595-629.

Blau, D. M. and R. T. Riphahn, 1999, Labor force transitions of older married couples in Germany, Labour Economics 6, 229-251.

Clair, P. and D. Blake, 2008, RAND HRS Data documentation, 103-111, 127-128, 137-141, 261-263, 576-588, 913-918, 997-1000. Retrieved April 8, 2008, from http://hrsonline.isr.umich.edu/meta/rand/randhrsg/randhrsg.pdf

Enrenberg R.G. and R.S. Smith, 2005, Modern labor economics: Theory and public policy, (New York: Pearson Addison Wesley) 165-192, 207-228.

Greene W.H., 2008, Econometric analysis, (Upper Saddle River, N.J.: Pearson/Prentice Hall) 817-826.

Parsons, D.O., 1977, Health, family structure, and labor supply, American Economic Review 67, 703-712.

Pienta, A.M., 2003, Partners in marriage: An analysis of husbands' and wives' retirement behavior, Journal of Applied Gerontology 22, 340-358.

Wooldridge J. M., 2003, Introductory econometrics, (Australia; Cincinnati, Ohio: South-Western College Publishing) 616-635.

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