Determinants of Labor Force Participation of Older Married Men in Taiwan*

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Abstract:

As the proportion of older population increases in Taiwan, issues related to older individuals' labor market behavior attract public attention. This paper tries to identify the determinants of older married men's labor force participation in Taiwan. We use data from Manpower Survey and Manpower Utilization Survey from 1988 to 2008. The sample comprises 51,730 observations of married men aged 55-64. Decompositions with methodologies of Oaxaca (1973) and DiNardo, Fortin, and Lemieux (1996) are conducted for explaining the decline in labor participation rate of older married men. The results indicate that the increase in wives' labor force participation increases husband's likelihood of participation and has prevented aggregate husbands' participation rate from declining to the extent of about 1 percentage point. However, regional unemployment rate negatively affects husbands' likelihood of participation and explains at least 3.5 percentage points of the total decline in husbands' participation rate.

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I. Introduction

Understanding changes in labor force participation rate of the elderly is important because of the fast aging population. According to Taiwan Statistical Data Book 2009, percentage of population over 65 years old in Taiwan has rapidly risen from 4.3% in 1980 to 10.4% in 2008, and it is projected to be 35.9% in 2050 (Population Projections for Taiwan 2008-2056). In fact, the phenomenon of population aging is not unique to Taiwan; it is happening in almost every developed country. In OECD countries, the percentage of population over 65 years old reached 14.4% in 2008 and is projected to be 25.2% in 2050 (OECD ALFS summary tables and OECD population pyramids 2000 and 2050). Since the proportion of older people in Taiwan's population is increasing, labor force participation rate of the elderly is playing an increasingly important role in its economy. Changes in older men's labor force participation rate influence economic factors such as labor productivity and government finances, and social factors such as social resources allocation and families' economic burdens. Therefore, determinants of older men's labor force participation rate have already started attracting public attention and have become a crucial issue for policy makers and researchers too.

Today in Taiwan, more middle aged men decide to leave the labor force than was the case 30 years ago. Between 1978 and 2008, labor force participation rate of men aged 55-64 years in Taiwan decreased from 88.6% to 60.3% (Manpower Survey). This large decline has motivated this paper as we investigate labor force participation rate of older men in Taiwan, and try to answer the questions "why fewer older men are participating in the labor force in recent years?" and "what factors might be responsible for this decline?"

Based on previous literature and data characteristics, we then focus on two possible answers: (1) increase in their wives' labor force participation; and (2) local labor market shocks. One possible conjecture is that labor participation decisions of husbands might have been affected by the increase in the rate of married women's labor participation. Review of

economic theories and extant empirical literature suggests that married women's labor force participation might affect their husbands' behavior through either income effect or shared leisure effect. Since the 1980s, the increase in female labor force participation rate has been one of the most significant demographic changes in almost every developed country. In all OECD countries, labor force participation rate of women aged 55-64 rose from 36.3% in 1980 to 46.2% in 2008 (OECD ALFS summary tables). According to the Manpower Survey in Taiwan, labor force participation rate of women aged 55-64 increased from 18.1% to 28.8% between 1978 and 2008. This change is not driven only by the growing number of single women as is evident from the trend being equally pronounced among married women. In fact, labor force participation rate of married women aged 55-64 also expanded by about 10 percentage points during the same period. To capture this effect, we consider a family context model and try to examine how a wife's labor participation decision determines that of the husband. We also study whether the increase in wives' labor participation accelerates or decelerates the decline in husbands' labor force participation. Finally, what proportion of change can it account for?

The local labor market conditions could be another factor affecting older men's labor force participation decisions. Local labor market shocks can influence those already in the labor market as well as potential participants. During an economic downturn, older men might experience some shocks such as job loss or wage cut which may change their attitude towards participating in the labor force. Based on Taiwan Statistical Data Book 2009, the aggregate unemployment rate in 1988 was 1.69 percent but it hit 4.57 percent in 2001 and has remained above 3.9 percentage points till date (see Figure 3). However, not every county level unemployment rate follows the aggregate trend. In fact, unemployment rates vary among different counties in Taiwan. So we can identify different local labor market conditions by exploiting differences in regional unemployment, at the county level. Here we use county level unemployment rates in each year as a proxy for local labor market

conditions. And we try to answer whether a higher unemployment rate discourages older people from participating in labor markets. Also, how large is the change in older men's labor force participation rate after an increase in local unemployment rate?

To sum up, this paper specifies and estimates a labor force participation decision model to explain the decline in older men's labor force participation rates. Pooled cross-sectional data from the Manpower Survey and Manpower Utilization Survey in Taiwan for the period from 1988 to 2008 is used. 51,730 married men aged 55-64 were selected as sample. We construct a probit and a bivariate probit model to describe older men's labor market participation decisions. For examining wives' effect in the model, we follow Schirle (2008) to exploit older women's cohort effects to identify effects of wives' participation on their husbands in the model. Furthermore, for examining the effects of local labor market shocks, unemployment rates of different counties in each year are input as an independent variable in the model. Besides estimating the marginal effects of determinants in individual decision models, we decompose the overall older men's participation rate in our sample.

The main results show that if a wife is in the labor market, the probability of the husband's participation increases at least 6% on average. Besides, a 1% increase in local unemployment rate may reduce by about 1.5% the probability of older married men's participation on average. The decomposition shows that about 40% of changes in older men's participation rate between 1988 and 2008 can be attributed to local unemployment rate. Moreover, increase in labor participation rate of older married women explains about -8% of the decline, that is, labor force participation rate of their husbands would decline 1.6% without this change (the increase in women's participation rate).

The next section presents the background for this paper including the related empirical literature. Section III outlines the theoretical model of older men's participation decisions and how factors like local labor market conditions affect them. Section IV describes the data and recent trends of labor force participation rate. Section V provides details of empirical

specifications and methodology of bivariate probit and decomposition. Section VI presents empirical results, decomposition results, and robustness checks. The last section concludes the paper.

II. Background and Literature

For older individuals, labor force participation rate is a good and simple indication of their economic activity. Participation in the labor force is defined as whether an individual worked for pay or sought employment (unemployed) during the survey period. Studies on labor force participation rates of older men cover some retirement studies also and capture individuals' temporary decisions on labor market participation.

To explain the labor force participation decisions of older men (or retirement decision), some of the studies focus on social security, pensions (Anderson, Gustman and Steinmeier, 1999; Gustman and Steinmeier, 2005; Gruber and Wise, 2004; Coile and Gruber, 2007; and Mastrobuoni, 2009). Some studies highlight family issues (Peracchi and Welch, 1994; Blau and Riphahn, 1999; and Gustman and Steinmeier, 2000). Others emphasize special aspects like health insurance, technological change, and stock market (Bartel and Sicherman, 1993; Gruber and Madrian, 1995; Blau and Gilleskie, 2006; and Coile and Levine, 2005). This section introduces and summarizes some theoretical models, empirical specifications, and their results relevant to this paper.

First, we start with the basic theory of labor force participation. Older men in the labor force may consider full or partial retirement (Gustman and Steinmeier, 1984), while nonparticipants may consider entering the labor force. Previous literature has often depicted their decisions in a basic neoclassical model which proposes maximizing utility, subject to budget constraints. Utility functions characterize different preferences regarding leisure and consumption patterns, while budget constraints include expected lifetime earnings and retirement benefits. For example, Gustman and Steinmeier (1986) focused on retirement decisions using a life time utility model with a lifetime budget constraint that specified the

present value of social security and pension benefits. Parsons (1980) transformed a neoclassical utility model into a labor supply function which might include labor force participation decisions, personal characteristics, income, wealth and expected benefits from social security and pension.

As married women's labor force participation rate has risen, for a complete view, it is necessary to consider labor participation decisions in a family context, i.e. the interactions between a husband and a wife. Gustman and Steinmeier (2004) pointed out that "it is not possible to understand the retirement decision of one spouse without considering the behavior of the other," as wealth, consumption, leisure and other considerations are determined jointly in a family. Therefore, some researchers view the question of an older men's retirement decision as his whole family's decision.

Family labor force participation often refers to a basic family joint utility model or a bargaining model. A joint utility model assumes that family members maximize their joint utility over total consumption and individual leisure subject to budget constraints. So, older men make their retirement decisions based not only on their own preferences, benefits and opportunity costs, but also take family income and household consumption into account (Blundell and MaCurdy, 1999; Ehrenberg and Smith, 2009). Another alternative way to look at family labor participation is to use a bargaining model. The bargaining model treats married couples' decisions as the consequences of bargaining. The bargaining power of each spouse is determined by his or her threat point. McElory and Horney (1981) noted that the existence of a threat point can relax some limitations of the joint utility model.

Most family retirement literature use longitudinal data and construct a dynamic model, and most of them have found that social security incentives and retirement dates of wives have strong influence on older men's participation in labor force. Blau (1998) analyzed the dynamics of joint labor force participation of older married couples from Retirement History Survey and found that labor force transition probability of one spouse was strongly associated

to the labor force status of the other in the United States. Blau and Riphahn (1999) constructed a dynamic family labor supply model and a dynamic cooperative bargaining model using the data of German Socio-Economic Panel (GSOEP). They found that an individual was more likely to retire if the spouse is not employed than if the spouse is employed. Gustman and Steinmeier (2000) investigated causes of joint retirement decisions using the data from National Longitudinal Surveys of Mature Women (NLS). Their results revealed that a wife's retirement decision was not strongly influenced by the husband's, but the husband's retirement decision was indeed strongly influenced by the wife's. Gustman and Steinmeier (2004) exploited a measure of how much the couples enjoy their time with each other, on retirement, to simulate retirement behaviors. They found that interdependence of a husband's and wife's retirement decision exists. Moreover, husbands are more likely influenced by their wives' retirement status than their wives. Coile (2003) used Health and Retirement Survey (HRS) in the U.S., and found that men were very sensitive to their spouses' retirement incentives like social security and private pension but women were not.

Some studies rely on cross-sectional pooled data which have alternative viewpoints and larger sample sizes. For example, Zweimuller, Winter-Ebmer and Falkinger (1996) used a bivariate probit to study the probability of interdependence between retirement decisions of spouses from Austrian data. They controlled for personal characteristics, city size, regional unemployment rate and earnings, and found the magnitude of husbands' reactions to changes in wives' minimum retirement age to be large. Their results revealed an asymmetry that husbands respond to changes in wives' retirement age but wives' don't respond to change in husbands' retirement age. Schirle (2008) used data from the United States, Canada and the United Kingdom to study labor force participation rate of older men. Schirle (2008) found that at least 25 percentage points increase in older married men's participation rate since mid-1990s can be explained by the increase in their wives' labor force participation. Masrbuoni (2009) studied effects of cuts in retirement benefits on retirement behavior and

found that benefit cuts increase the mean retirement age.

Economic conditions, especially labor market conditions, also play an important role in older men's participation decisions. Labor market fluctuations affect participation decisions by two opposing effects, "discouraged worker effect" and "added worker effect." When it is a recession, the discouraged worker effect discourages people from either entering or staying in labor markets. Usually, involuntary unemployment implies older men take more time to get reemployment (Chan and Stevens, 2001). Even potential labor force participants often delay their entry due to the hard times. So, if the discouraged worker effect exists, an increase in unemployment rate decreases the likelihood of older men participating in the labor force. On the other hand, there is the added worker effect which is the way a family member responds to job loss of another family member. For example, a husband might be more likely to enter labor force if his wife gets unemployed.

Previous studies reveal that bad labor market conditions reduce older men's labor participation probability. That is, probability of labor participation increases when the local unemployment rate falls. Coile and Levine (2007) use March Current Population Survey (CPS) and Matched March CPS data to examine how labor market condition, i.e. the regional unemployment rate, affects individuals' retirement decisions. They found a 3 percentage points increase in unemployment rate raises the retirement probability by about 5 to 10 percentage points. Hallberg (2008) studied old workers' retirement decisions in Sweden emphasizing demand side factors. The study indicated that a downturn in aggregate industry employment increases early retirement probability, particularly in the public sector. Sung and Ahn (2006) examined determinants of decisions of older persons to work, based on data from the Korea Labor and Income Panel Survey (KLIPS). They found that the local unemployment rate had a strong negative effect on employment probability of individuals aged 45 and older.

In Taiwan, many empirical studies on determinant factors of labor force participation rate have been conducted. Lin (1997) used an ordered probit model to analyze older people's

full/partial retirement decisions. Lin (1997) found some important factors that influenced retirement decisions such as pension, health status and working experiences. Hsieh (2008) used a longitudinal dataset from the Survey of Health and Living Status of the Middle Aged and Elderly in Taiwan (SHLSET) and modeled individuals' retirement decisions using a hazard model. Hsieh (2008) found that National Health Insurance (NHI) raised by more than 60% the conditional probability of retirement for a middle-age man working in the private sector. Furthermore, male employees with more adult sons had a significantly higher conditional probability of retirement than men with fewer sons. However, Mete and Schultz (2007) used the SHLSET data and found that though implementation of NHI in 1995 reduced the cost of healthcare for the elderly, it cannot be said to have contributed to a reduction in elderly participation rates in 1996.

In the context of the family model, most empirical works employ a joint family utility model and focus on studying female labor supply in Taiwan (Chuang and Lin 2006). Huang (2007) studied retirement age from a family point of view by using the Manpower Survey of 1997. The main finding of Huang (2007) showed that retirement age would depend on spouse's expected retirement age and family income. San (1988) and Chuang and Lin (2006) both found the effect of wife's wage elasticity on husband's labor supply iwas larger than the effect of husband's wage elasticity on wife's labor supply. That is, wife's wage strongly influenced husband's labor supply but husband's wage had a smaller effect on wife's labor supply.

Regional unemployment rate in Taiwan has been studied by many researchers. Jiang (2001) indicated that the number of discouraged workers and hidden unemployed persons rose about 60,000 between 1997 and 2000 (Manpower Survey) because of increased usage of cheap foreign workers. Luoh (2003) analyzed the added workers effect, i.e. the impact of husbands' unemployment on their wives' labor participation. The results suggest that the added worker effect did exist in each period in Taiwan especially during periods when

unemployment rate was high. Mete and Schultz (2007) considered regional unemployment rates in their regressions, and showed that higher regional unemployment rates deterred male labor force participation. Jiang (2005) investigated and estimated panels of regional unemployment rates by two-factor fixed-effects model. The results indicated that there existed differences between regional unemployment rates in different counties.

Thus, the main contribution of this paper is that we extend the literature on older men's labor force participation in Taiwan in three aspects. First, we use a family labor supply model and a bivariate probit specification to estimate determinants of husbands' labor force participation decisions. Second, we focus on the contribution of regional labor market shocks on labor force participation rate, a really important issue that has not been addressed before. Finally, the methodologies in Oaxaca (1973) and DiNardo, Fortin and Lemieux (1996) are employed to determine what proportion of the trend can be explained by these two factors, i.e. wife's participation effect and regional labor market conditions, besides other personal characteristics.

III. Empirical Model

We consider a classical static labor supply model in a family context which helps us setup empirical specifications. A husband's labor force participation decision function is shown in Equation (1):

$$L_{it}^{H*} = U^H(L_{it}^H, L_{it}^W, X_{it}^H, X_{it}^W, X_{it}^{family}, un_{it} \mid L_{it}^H = 1) - U^H(L_{it}^H, L_{it}^W, X_{it}^H, X_{it}^W, X_{it}^{family}, un_{it} \mid L_{it}^H = 0). \quad (1)$$

The husband's utility function (U^H) depends on his and his wife's labor force participation status (L_{it}^H and L_{it}^W), his and his wife's individual characteristics (X_{it}^H and X_{it}^W), characteristics of his family (X_{it}^{family}) and local labor market condition (un_t). L_{it}^H and L_{it}^W are dummy variables. $L_{it}^H = 1$ (or $L_{it}^W = 1$) means a husband (or wife) is in the labor force,

and $L_{it}^{H}=0$ (or $L_{it}^{W}=0$) means he (or she) is not. A husband decides to participate in labor force when the latent variable $L_{it}^{H*}>0$, which implies that if the utility conditional on $L_{it}^{H}=1$ exceeds the utility conditional on $L_{it}^{H}=0$.

Under a family joint decision making setting, it is very likely that a husband takes his wife's labor force participation decision into account when making his own labor participation decision. A husband's decision might also be affected by his wife's individual characteristics like age, educational attainment, etc. Thus, wife's choice of labor force participation L_{it}^{H}, and her individual characteristics X_{it}^{W}, are both included in the husband's utility function in Equation (1).

A wife's participation decision could affect the husband's participation decision in two different ways (Schirle, 2008). The first is the income effect. An increase in wife's labor supply brings more income to the husband. This income effect increases the utility of the husband, and it eases the burden of raising children and finally makes the husband reduce his labor supply (increase his leisure). The second is a positive "shared leisure effect" for the husband's labor force participation. That is, a decline in a wife's labor supply (like retirement or partial retirement) increases husband's utility in terms of leisure, and reduces the likelihood of his labor force participation.

The shared leisure effect implies that when both husband and wife retire (or partially retire), they might have some preferences for spending leisure time together. A retired husband might not enjoy his leisure time alone if his wife still needs to work. Also, husbands who leave the labor force earlier than their wives would be thought of as dependants of their wives, which would invite humiliation by peers under the Chinese cultural ethos.

Thus, the effect of an increase in wives' labor supply depends on magnitudes of the two opposite effects, i.e. income effect and shared leisure effect. If the shared leisure effect is

larger than the income effect, increase of a wife's labor supply may increase her husbands' likelihood of labor force participation. If the shared leisure effect is smaller or equal to income effect, increase in a wife's labor supply decreases her husband's likelihood of labor force participation.

Besides, local labor market condition un_t might also affect the utility. For example, local labor market condition could change older men's optimal choice. In Equation (1), county-level unemployment rates enter into the utility function as a proxy of local labor market condition. It means one's utility level may be changed by unemployment rate in the county of residence. For example, when facing an economic downturn, a worker may experience a job loss or a longer job searching period. An unexpected job loss would be an obstacle for future reemployment (Chan and Stevens, 2001). A longer job searching period discourages people from being in labor market and it even discourages potential participants from entering. So, we expected a negative relationship between utility and county-level unemployment rate, and also a negative relationship between county-level unemployment rate and labor supply.

A wife's labor force participation decision function is shown in Equation (2):

$$L_{it}^{W*} = U^W(L_{it}^W, X_{it}^H, X_{it}^W, X_{it}^{family}, un_{it}, Z_{it}^W \mid L_{it}^W = 1) - U^W(L_{it}^W, X_{it}^H, X_{it}^W, X_{it}^{family}, un_{it}, Z_{it}^W \mid L_{it}^W = 0). \quad (2)$$

Similarly, a wife decides to participate in labor force when $L_{it}^{W*} > 0$ and decides not to participate when $L_{it}^{W*} < 0$. Notice that in Equation (2), factors affecting wife's utility function are very similar to the husband's except the husband's labor force participation status L_{it}^H is not in wife's utility function, and a cohort effects variable, Z_{it}^W, is added.

Several reasons explain the absence of husband's labor force participation status in the wife's utility function. First, from the empirical studies we discussed earlier, like Gustman and Steinmeier (2000), Gustman and Steinmeier (2004), Coile (2003), and Zweimuller et al.

(1996), wife's retirement decision is not strongly influenced by the husband's. Second, if husband's labor force participation decision enters into wife's decision function, the empirical specification will be logically inconsistent when a husband and wife's decisions (Equations [1] and [2]) are jointly modeled. This is the so-called logically inconsistent problem. A problem of logical inconsistency occurs when a husband's labor force participation decision is considered in the wife's decision function (Maddala, 1983). This kind of a model is logically inconsistent because the sum of the likelihoods is not equal to one unless wife's participation status variable, L_{it}^{W}, is not in the husband's decision equation.

Here we add one more variable (cohort effects Z_{it}^{W} based on Schirle, 2008) in wife's utility function but not in the husband's. The wife's cohort effects are used as an exclusion restriction. This exclusion is like an instrumental variable in linear models which can identify the husband's decision function. Wives' labor force participation rates of different cohorts at age 35 (Z^{W}) is the exclusion restriction which requires no correlation with the error term applied in the husbands' decision function. In fact, going by theory, young husbands would consider retirement decisions taking into account their own and their wives' labor market productivity, and wealth, but not the cohort's participation rate of their wives. Therefore we assume that the cohort effects do not directly influence husbands' decisions. Cohort effect Z^{W} represents working arrangement of a wife's cohort but needs to have enough variation across different cohorts.

The decision functions in (1) and (2) can be assumed in a linear functional form. To estimate the first single model of Equation (1), we use a probit model of the following form:

$$L_{it}^{H*} = L_{it}^{W}\gamma^{H} + X_{it}^{H}\beta^{H} + X_{it}^{W}\beta^{HW} + X_{it}^{family}\beta^{HF} + un_{it}\beta^{HU} + \varepsilon_{it}^{H} \qquad (3)$$

To estimate a husband and wife's joint decisions, a recursive bivariate probit model is used, which takes the form as below.

$$
\begin{aligned}
L_{it}^{H*} &= L_{it}^{W}\gamma^{H} + X_{it}^{H}\beta^{H} + X_{it}^{W}\beta^{HW} + X_{it}^{family}\beta^{HF} + un_{it}\beta^{HU} + \varepsilon_{it}^{H} \\
L_{it}^{H*} &= X_{it}^{H}\beta^{WH} + X_{it}^{W}\beta^{W} + X_{it}^{family}\beta^{WF} + un_{it}\beta^{WU} + Z_{it}^{W}\beta^{WZ} + \varepsilon_{it}^{W} \qquad (4)
\end{aligned}
$$

In both probit and bivariate probit models, we can expect that if shared leisure time effects are larger than income effects, the marginal effect of wives' labor force participation (γ^{H}) would be positive. And if local labor market condition has an influence on a married man's decision, the marginal effect of county-level unemployment rate (β^{HU}) would be negative and significant.

The bivariate probit model can be taken as an application as in Wooldridge (2002) section 15.7.3, a case where the probit model contains a binary explanatory variable that is endogenous. We assume Z_{it}^{W} is uncorrelated to ε_{it}^{H}, and $(\varepsilon_{it}^{H}, \varepsilon_{it}^{W})$ is distributed as bivariate normal with mean zero, each has unit variance, and $\rho = Corr(\varepsilon_{it}^{H}, \varepsilon_{it}^{W})$. If $\rho = 0$, these two equations can be regarded as two independent probit models and estimated separately.

If $\rho \neq 0$, then ε_{it}^{H} and ε_{it}^{W} are correlated, which means estimates of γ^{H} and β^{H} in the single probit model for Equation (3) are inconsistent because when estimating only the husband's labor force participation, error terms in the wife's decision function (ε_{it}^{W}) enter into husband's function through wife's labor force participation (L_{it}^{W}). So we cannot correctly identify the real coefficient (γ^{H}) and the correlation (ρ). Thus the bivariate probit method provided by Maddala (1983) and Wooldridge (2002) is used.

We apply decomposition methods from Oaxaca (1973) and DiNardo, Fortin and Lemieux (1996) to decompose the effects from wife's labor force participation status, personal characteristics and other variables. Basically, a counterfactual probability is first constructed for each year in the sample period by using the estimated coefficients of 1988.

For example, the counterfactual probability in 1989 is $\overline{LF}_{89}^{88} = \overline{X}_{89}\hat{\beta}_{88}$, where $\overline{X}_{89}$ is the vector of sample means for independent variables in 1989, and $\hat{\beta}_{88}$ is the coefficient of X in 1988. Then, the differences in counterfactual and real probabilities reveal the percent change that can be attributed to the unexplained part of variable *X*.

The Oaxaca decomposition emphasizes first moment differences and coefficient differences between two groups. However in nonlinear functions like bivariate probit model, Oaxaca decomposition is problematic since it is parametric. So we apply a semi-parametric DiNardo-Fortin-Lemieux Decomposition which follows a similar spirit and can be easily applied in nonlinear models.

IV. Data

The data for this paper come from the Manpower Survey and the Manpower Utilization Survey. Manpower Survey of Taiwan is a quarterly labor force survey started in October 1962 by the Labor Force Survey, Statistics, Research and Development Group. In view of the growing importance of manpower planning, the Directorate General of Budget, Accounting and Statistics (DGBAS) of Executive Yuan took over the Taiwan area labor force survey (i.e. Manpower Survey) in 1977. After the DGBAS took over the Manpower Survey, it changed the quarterly survey into a monthly survey and improved the sampling method. In January 1978, DGBAS began to interview civilian population over 15 years old in randomly selected households of all 23 counties and cities in Taiwan. The questionnaire includes basic data, such as individual characteristics, labor force status, working conditions, reasons of nonparticipation, reasons of unemployment, etc. Also, once a year, in May, a supplementary survey, the Manpower Utilization Survey, is conducted with the same sample. It has more information about reasons of leaving the labor market. So we use the available yearly datasets of these two surveys for this study.

We matched heads of households and spouses of heads to identify couples, and

selected males who were married and were aged 55 to 64 in the period 1988 to 2008. The Labor Standards Act in Taiwan says "A worker may apply for voluntary retirement if he attains the age of fifty-five and has worked for fifteen years," though most social security benefits and pensions for the elderly start at age 65. Therefore, for simplifying the analysis, age group between 55 and 64 was chosen. Until 1988 the survey did not include the information of number of children in households. Therefore, data were used from 1988 onwards. The year 2008 is the latest period for which data were available during the research.

The key dependant variable is labor force participation status. There is a question in Manpower Survey which asks "what did you do last week?" If a respondent answered "work", "part-time work", "job searching or wait for a reply" we categorize he/she as participating in the labor force. If he/she answered "intend to work but not seek for", "housekeeping", "retirement", etc., we categorize him/her as not participating in the labor force. We excluded individuals who were in military or attending school.

We also include several independent variables in the data set. First, we divide educational attainment into seven categories. Number of children is provided in the data set. We also construct a variable which measures cohort-specific participation rates at age 35. Women born in 1920-69 are classified into five ten-year cohorts. County-level unemployment rate is also included. The unemployed population is divided by the population in the labor force for each county in each year to get the county-level unemployment rates.

The descriptive statistics are reported in Table 1. In our sample, we had 51,730 observations for the period 1988-2008. As we can see, labor force participation rate of married men declined 8 percentage points from 1998 to 2008 in the full sample (i.e. 0.71 to 0.63). It decreased by 11 percentage points (i.e. 0.64 to 0.53) for those whose spouses were not in the labor force. As noted earlier, we focus on the increase of female labor force participation for explaining the trend in male labor force participation. Here we can find that labor force participation rate of spouse rose 7 percentage points (0.32 to 0.39) between 1988

and 2008.

Other covariates of interest are the change in educational attainments and family structures. Because of compulsory education and the economic growth, both men and women became more educated over the years. For instance, proportion of those with elementary school or below dropped from 68 percent to 43 percent for men, and from 88 percent to 53 percent for women. Moreover, during the two decades the age difference between husband and wife became smaller and the number of children in families also declined.

In order to understand the trend in labor force participation rate, labor force participation rate of older married couples by sex is presented in Figure 1. The labor force participation rate of married men plunged 18 percentage points between 1978 and 1983, and held steady at around 72% until 1997. Between 1997 and 2004, the participation rate fell from 71% to 60%, and then rose about 2.7 percentage points in 2004-2008. On the other hand, except for 1978 to 1984, their wives' participation rate rose significantly, by 20 percentage points between 1984 and 2008.

We have emphasized local labor market shocks. Here we report the trend in the unemployment rate and labor force participation rate of our sample. As shown in Figure 3, the aggregate unemployment rate and labor force participation rate move in opposite directions but there is a correlation between their movements. For example, before 1993 the unemployment rate moved moderately to the lowest point and the labor force participation rate in the same period moved somewhat more actively to its peak. Besides, between 1993 and 2002, the unemployment rate increased 3.4 percentage points to its peak (almost tripled from the lowest rate), while in the same period, the labor force participation rate decreased 13.2 percentage points and went down to its lowest point in 2003.

In Figure 4, we present the dotted plot where y axis is the county-level labor force participation rate of married men aged 55-64, and x axis is the county-level unemployment rate of all aged 15 or above. We can see that fewer points lay in small x and small y, and also

in large x and large y. As a fitted line presents a negative slope, there would be the probability that unemployment rate is negatively correlated to labor force participation rate.

For identifying the regional unemployment effects in the models, variation of unemployment rates between counties and cities should be large enough. Table 2 presents older married men's labor force participation rates and local unemployment rates for several randomly selected regions including Taipei City, Kaohsiung City, Taitung County, and Pingtung County in even-numbered years. We can see from the first four rows that people in Taitung and Pingtung have higher participation rates than people in Taipei City and Kaohsiung City. The other four rows show that unemployment rates in these four cities and counties moved upward but changed differently over time. Differences between counties are not only significant but also persistent (Jiang, 2005; and Jiang and Liu, 2005). Thus, variations in different local unemployment rates did exist.

As noted earlier, cohort-specific participation rates of women of age 35 (cohort effects, Z_t^W) are included in wife's participation function as an exclusion restriction. However variation of this exclusion restriction also has to be large enough for identification. Figure 5 shows labor force participation rates of women in different birth cohorts, by different age groups. We can see that women in younger cohort groups are more likely to participate in the labor force while in their prime. For example, in their prime age (30-45), participation rate of women born in 1960-1969 is higher than participation rate of women born in 1940-1949.

V. Empirical Results

Results of probit and bivariate probit estimates are shown in Table 3. Older men's labor force participation is taken as a dependant variable. Wife's participation decision, own education level, own age, number of children, wife's education level, interviewed year, and county are treated as dummy covariates, while local unemployment rate and spouse's age are

treated as numerical covariates.

Husband's age and number of children are treated as dummies. A husband's age is categorized into ten groups, each age (55, 56, 57, etc.) making up a group. Dummies of number of children are defined as zero, one, two, three, four, five and more than five children. The use of dummies is much closer to the spirit of decomposition, and the dummies can also be more flexible. For instance, age being a numerical variable has only one coefficient so that the decomposition can capture only the difference of mean while age dummies have ten coefficients so that the decomposition can reflect more changes of distribution.

The marginal effects in second and fourth column are calculated at mean for numerical variables, effects for dummy variables are evaluated at zero to one by using the methodology of Anderson and Newell (2003) and Greene (2008). The estimate results first suggest that if the wife is in the labor force, the probability of husband's participation would significantly increase; about 18 percentage points in probit, and 6 percentage points in bivariate probit model. This result indicates shared leisure effects are larger than income effects, that is, wife's participation might negatively affect husband's likelihood of participation.

However, there is a 12 percentage points difference between the marginal effect of probit and bivariate probit model. The single probit model could overestimate marginal effect of the wife's participation because it ignores the correlation between ε_{it}^{H} and ε_{it}^{W}, in the single probit model, ε_{it}^{W} is in the husband's decision function, and estimates of the coefficient of wife's effect include both the real coefficient and correlation ρ between ε_{it}^{H} and ε_{it}^{W}. For example, if part of ε_{it}^{W} represents the passion for work, and correlation ρ is not equal to zero (i.e. a husband who enjoys his work might choose a wife who enjoys her own work too), wives with more passion for work are more likely to participate in the labor

market and so are their husbands. Thus, the estimate from a single probit model not only captures the true relationship between husband's and wife's participation, but it also includes how much their passions for work are correlated. In other words, a larger coefficient from the probit model could imply that both husband and wife have similar passion for participation. Hence, estimates from the bivariate probit model which takes this correlation into account is more reliable and give us more consistent estimations.

Another important effect for older married men is regional unemployment rates. A one percentage point increase in regional unemployment rate decreases older men's likelihood of participating by 1.5 and 1.7 percentage points for probit and bivariate probit models, respectively. This effect of labor market condition is significant. It implies that higher regional unemployment rate discourages older men from either entering or staying in the labor market.

In Table 3, other personal characteristics also play an important role in determining older men's decisions. Marginal effects of educational attainment are examined, and the results reveal that higher educational backgrounds increase the likelihood of participating, especially for university degree or graduate degree. In addition, wife's educational attainment and other control variables also influence husband's participating decision. The estimation results for wife's equation are available upon request.

Despite results on marginal effects being available, it is hard to say how the large effects of wife's participation or other variables can explain the change of the average labor force participation rate of husbands. Therefore, decompositions are conducted by methods of Oaxaca (1973) and DiNardo et al. (1996).

In Table 4, decomposition of OLS and probit models are presented in column one and two, respectively. For OLS results, participation rate of married men declines 8.4 percentage points which can be attributed to changes in wives' participation (-17.9 percent), to changes in unemployment rate (66.4 percent), and finally to unexplained part (53.5 percent). The

negative percentage points in wife's participation effect means if the participation rate of wives did not rise (remained unchanged in 1988), labor force participation rate of their husbands would have decreased .015 (18 percent of total change). The results for probit model in column two are similar to OLS. Besides, OLS and probit both show that changes in couples' characteristics and family status can explain only a little.

The labor force participation trends, real and counterfactual, between 1988 and 2008 are plotted in Figure 6. The counterfactual labor force participation rate when holding personal characteristics and wives' participation constant in 1988 is above the original labor force participation rate in 1999-2004, but is below that after 2007. It shows that if in 1999-2004, wives' participation rate and characteristics were the same as 1988, the hypothetical labor force participation rate would increase and vice versa. Also it is noteworthy that after holding the regional unemployment rate constant at 1988 level, the hypothetical labor force participation rate would increase significantly. Changes in regional unemployment rate can explain changes in labor force participation rate since 1996. Like in 2001, average unemployment rate gets to the highest point at .046 (.018 in 1988), so hypothetical labor force participation rate hits the highest point too. It means without the labor market shocks so far, the labor force participation rate would be even higher.

The methodology of DiNardo-Fortin-Lemieux (DFL) decomposition from DiNardo et al. (1996) is more proper for a nonlinear model because it is semi-parametric and provides more nonlinear properties. Applying the primary order from changes in unemployment rate, men's characteristics, and wives' participation, the results are shown in Table 5 and Figure 7. The first column of Table 5 is the decomposition result of probit model and the second column is decomposition result of bivariate probit model. For simplifying the analysis, as noted in the bivariate probit model, we ignore the endogeneity in the procedure of DFL decomposition. This simplification leaves the DFL decomposition unchanged in the probit model. Other variables such as husband's characteristics, wife's characteristics, and family

status are combined together into characteristics. The DFL decomposition has results similar to Oaxaca decomposition. Figure 7 reveals a smoother trend of counterfactual probability.

VI. Conclusion

As the proportion of the older population increases in Taiwan, issues of older individuals' behavior attract public attention. During 1988 to 2008, labor force participation rate of older married men declined over 10 percent. In this paper, we try to identify the determinants of older married men's labor force participation in Taiwan, and to explain the 10 percentage points decline. Data from Manpower Survey and Manpower Utilization Survey from 1988 to 2008 by DGBAS were used, and only married men aged 55-64 are selected. The sample size was 51,730.

Probit and bivariate models were used for labor participation decisions of older married men, and decompositions used are from methodologies of DiNardo et al. (1996) and Oaxaca (1973). The results indicate that wife's participation decision increases husband's likelihood of participation, and regional unemployment rate negatively affects husband's likelihood of participation. In addition, the increase in wives' labor force participation rate has prevented husband's labor force participation rate from declining to the extent of about 1 percentage point (-8 percentage points of total decline). The results also show that at least 3.5 percent or 40 percent of the total reduction in labor force participation rate of older married men during 1988 to 2008 can be explained by changes in regional unemployment rates.

These results provide another perspective for policy makers. That is, instead of worrying about the decline in older men's labor force participation, the key factor is to reduce regional unemployment rates. In fact, many older men might be willing to work but encounter a job loss during economic downturns, especially blue collar or people with lower educational backgrounds. In this situation, they might decide to exit the labor market.

Therefore, future policy analysis can or at least should focus on addressing regional labor market conditions, or on helping discouraged workers reenter the labor market.

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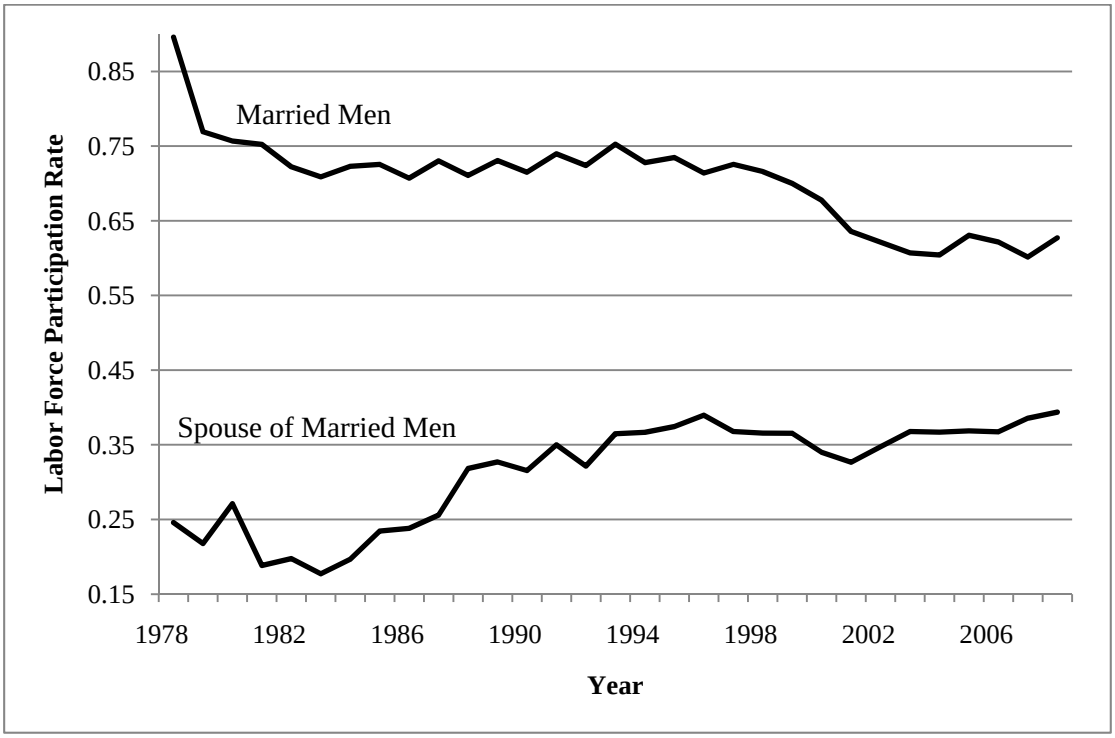

Figure 1 Participation rates of married individuals aged 55-64, by sex 1978-2008.
Source: Constructed using the Manpower Survey.

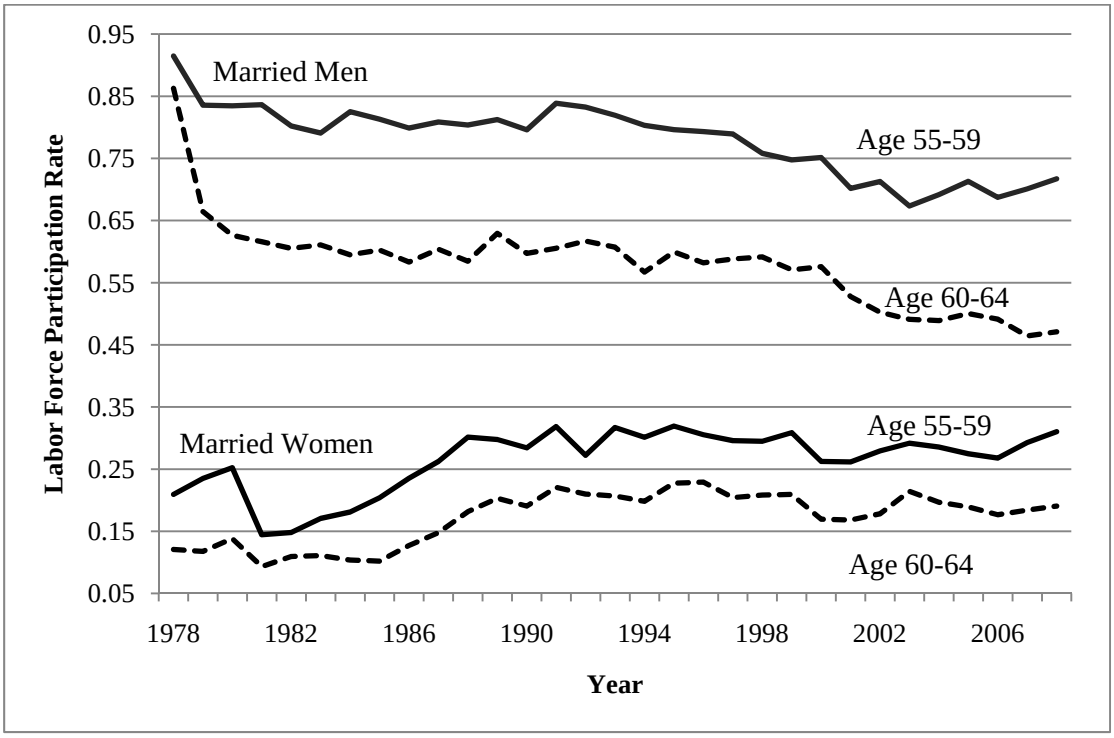

Figure 2 Participation rates of individuals aged 55-64, by sex and age, 1978-2008.
Source: Constructed using the Manpower Survey.

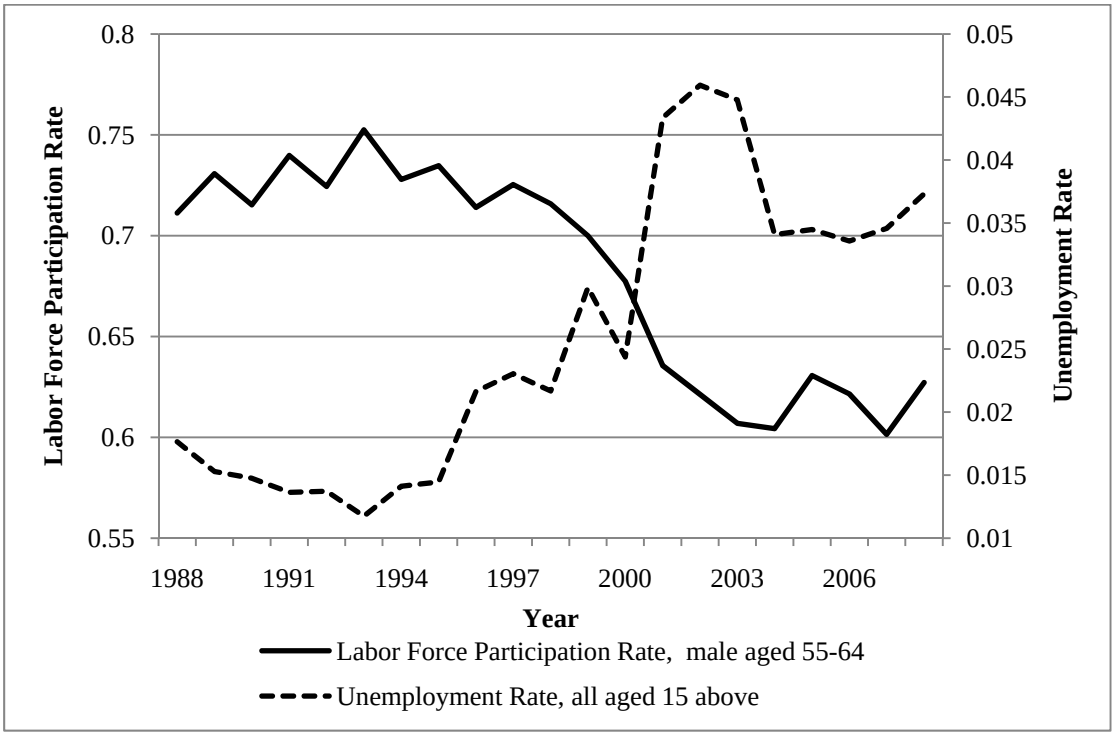

Figure 3 Aggregate Participation Rate and Unemployment Rate, 1988.
Source: Constructed using the Manpower Survey.

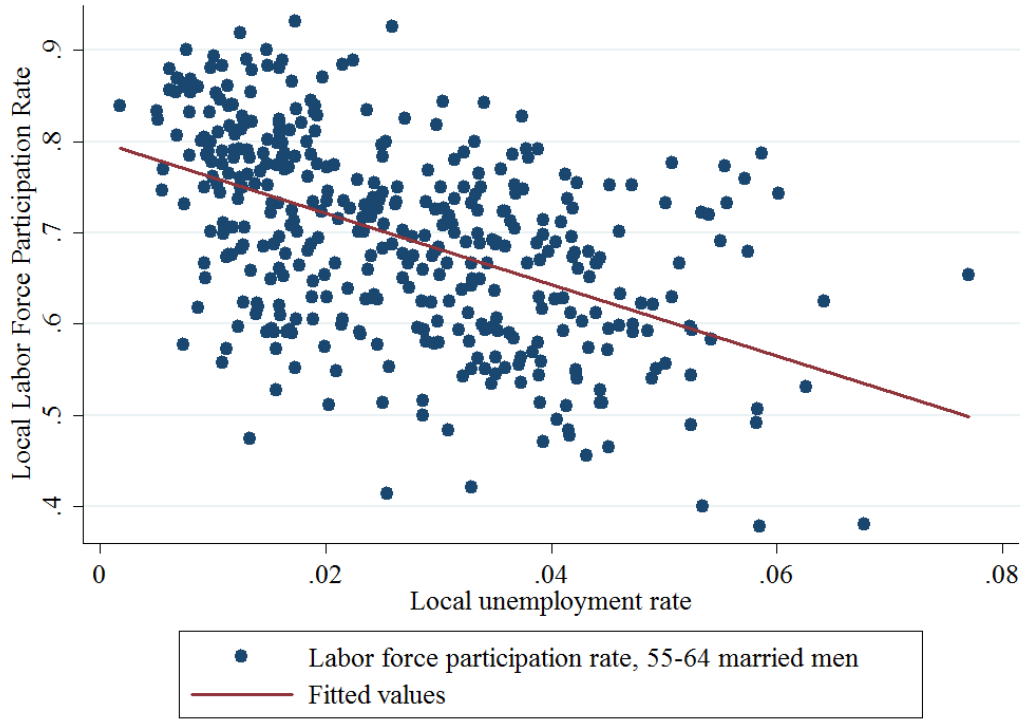

Figure 4 Participation Rate and Unemployment in County Level, 1988-2008
Source: Constructed using the Manpower Survey

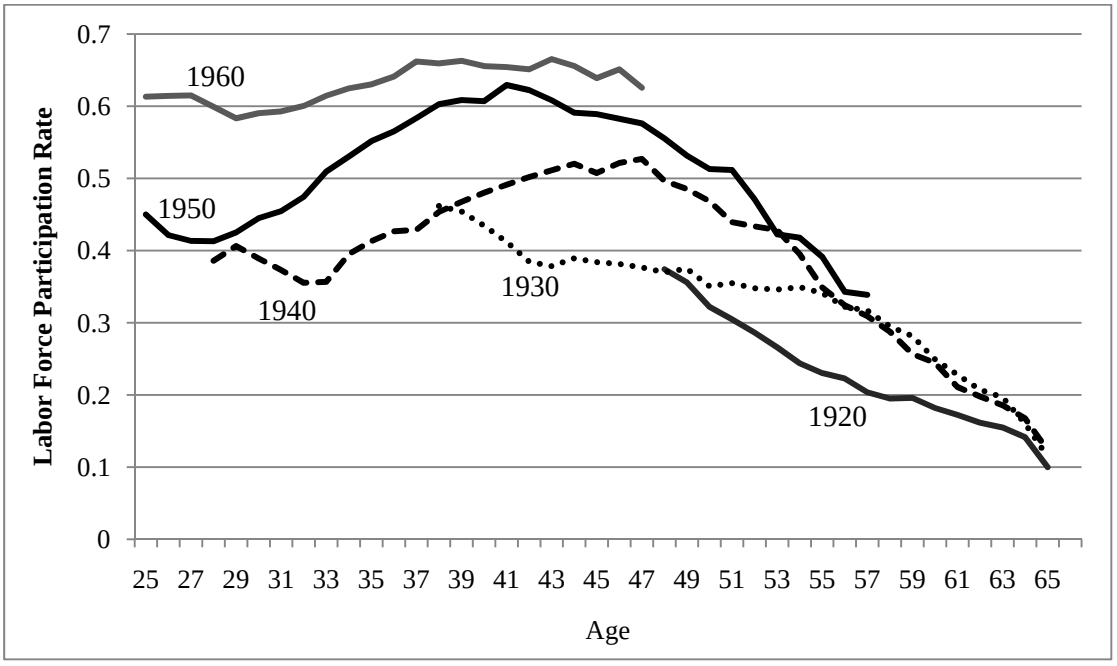

Figure 5 Age-participation profiles for selected birth cohorts of women.
Source: Constructed using the Manpower Survey

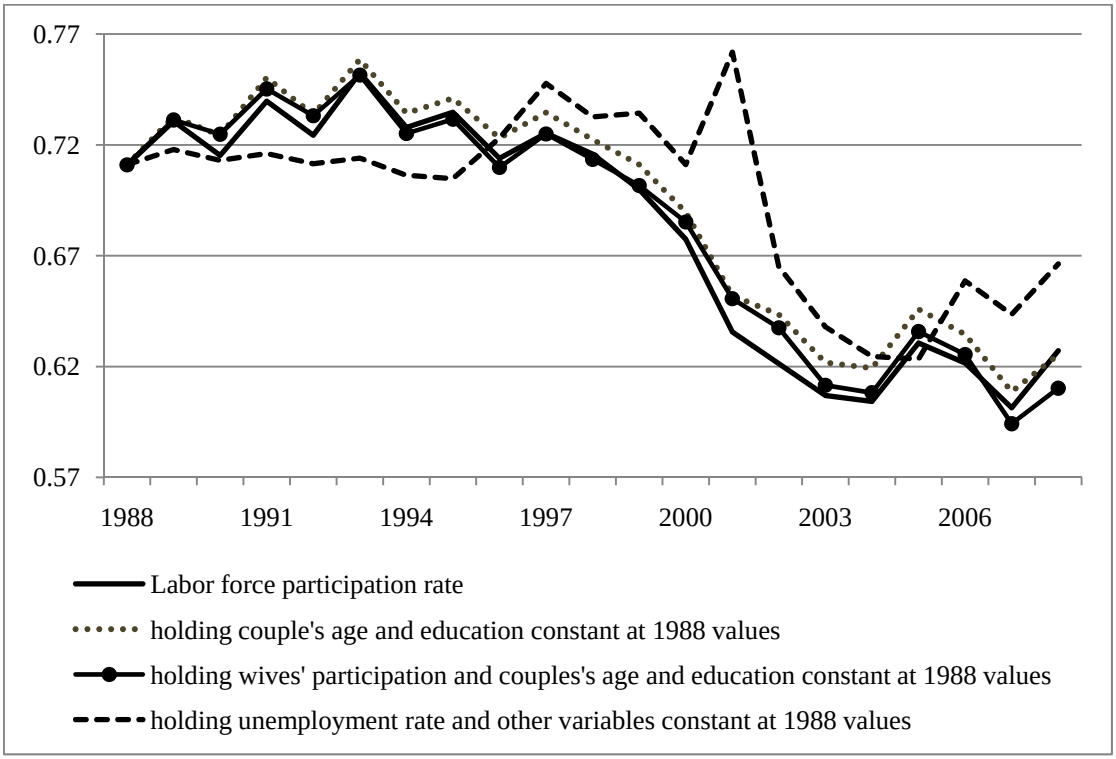

Figure 6 Participation Rate and Oaxaca Decomposition, OLS

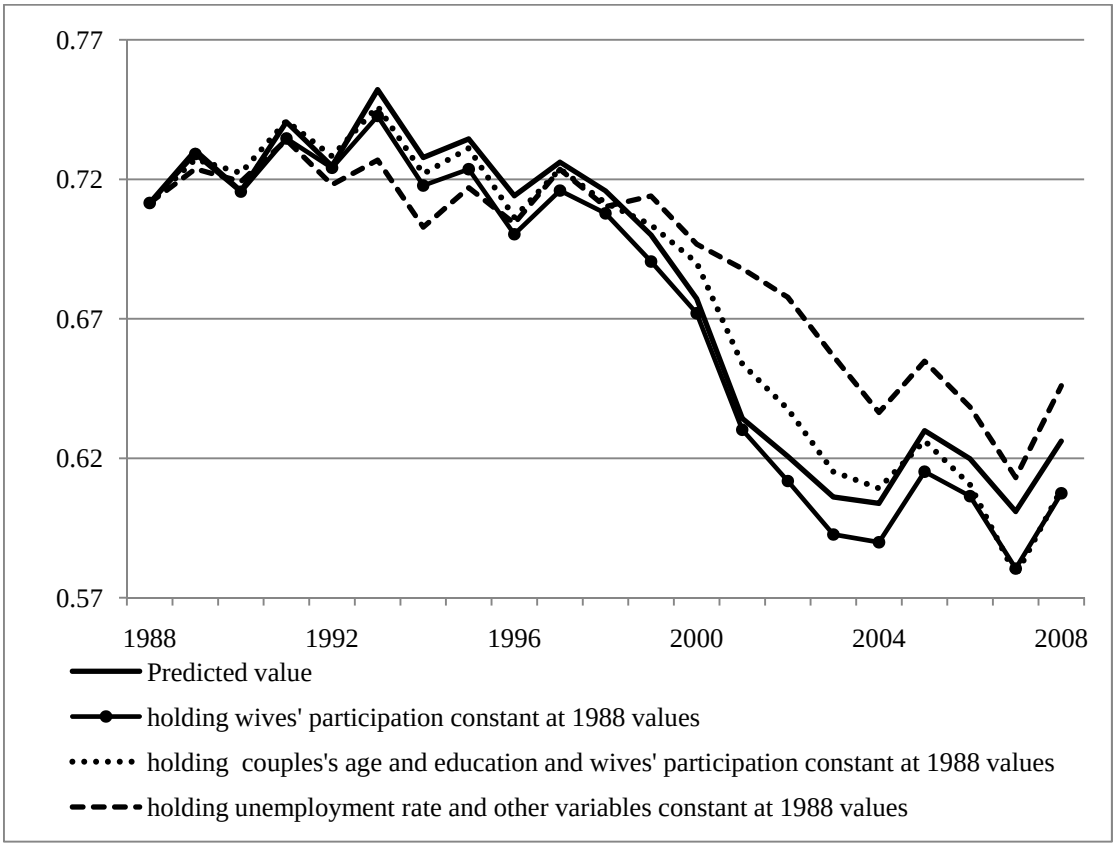

Figure 7 Participation Rate and DFL Decomposition, Probit

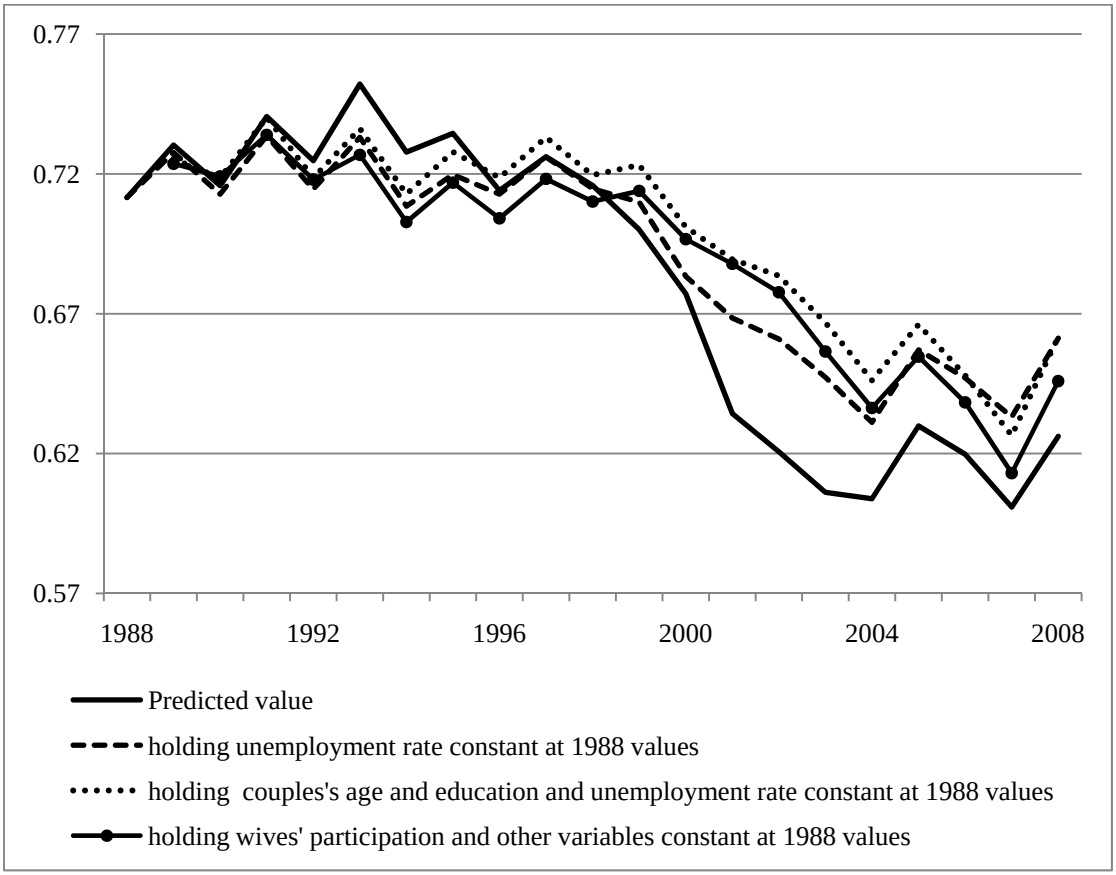

Figure 8 Participation Rate and DFL Decomposition, Probit

Table 1 Mean Characteristics of Married Men Aged 55-64, Taiwan

	All Married Men			Wife in Labor Force		Wife Not in Labor Force	
Age 55 to 64	All	1988	2008	1988	2008	1988	2008
Participation rate	0.68	0.71	0.63	0.86	0.77	0.64	0.53
Age	59.29	59.06	58.90	58.53	58.38	59.32	59.24
Education:							
No school	0.10	0.15	0.01	0.17	0.01	0.14	0.01
Elementary School	0.53	0.53	0.42	0.54	0.39	0.53	0.43
Junior high school	0.12	0.12	0.15	0.11	0.14	0.12	0.16
High school	0.14	0.11	0.21	0.09	0.24	0.12	0.19
College	0.05	0.04	0.08	0.05	0.09	0.04	0.08
University degree	0.06	0.04	0.11	0.04	0.11	0.04	0.11
Graduate/professional degree	0.009	0.002	0.027	0.001	0.022	0.003	0.029
Spouse:							
In the labor force	0.36	0.32	0.39	1	1	0	0
Age	55.55	55.01	55.29	54.27	54.43	55.35	55.84
Age difference	4.00	4.31	3.82	4.48	4.10	4.23	3.63
No school	0.27	0.43	0.03	0.46	0.03	0.41	0.04
Elementary School	0.51	0.45	0.50	0.40	0.45	0.48	0.54
Junior high school	0.09	0.06	0.14	0.05	0.14	0.07	0.14
High school	0.11	0.08	0.17	0.07	0.20	0.09	0.16
College	0.02	0.01	0.05	0.03	0.06	0.003	0.05
University degree	0.02	0.00	0.07	0.01	0.07	0.002	0.07
Graduate/ professional degree	0.002	0.0004	0.006	0.001	0.008	0	0.006
Number of children	3.53	4.06	2.78	3.95	2.69	4.11	2.83
Number of observations.	51,730	2,199	2,639	701	1,039	1,498	1,600

Source: Constructed using the Manpower Survey and Manpower Utilization Survey 1988-2008.

Table 2 Mean Participation Rate and Unemployment Rate in County Level

Labor Force Participation Rate, County Level (Married Men aged 55-64)											
	1988	1990	1992	1994	1996	1998	2000	2002	2004	2006	2008
Taipei City	.618	.591	.638	.597	.644	.620	.631	.598	.578	.581	.576
Kaohsiung City	.590	.475	.624	.636	.600	.543	.521	.557	.520	.643	.571
Taitung County	.727	.703	.820	.733	.755	.625	.840	.750	.685	.574	.681
Pingtung County	.667	.715	.761	.785	.775	.839	.699	.719	.723	.592	.782
Unemployment Rate, County Level (All Individuals age 15 above included)											
Taipei City	.021	.015	.015	.012	.026	.023	.024	.046	.030	.033	.038
Kaohsiung City	.017	.013	.015	.013	.022	.032	.039	.050	.035	.034	.049
Taitung County	.022	.018	.018	.029	.042	.029	.012	.030	.036	.043	.030
Pingtung County	.021	.021	.010	.016	.019	.019	.011	.031	.036	.035	.038

Source: All Constructed using the Manpower Utilization Survey 1988-2008.

Table 3 Results of Probit and Bivariate Probit
(Men's Labor Force Participation)

	Probit		Bivariate Probit	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Wife participation in the labor force	0.575**	0.188**	0.543**	0.062**
	(.014)	(.004)	(.021)	(.003)
Unemployment Rate, county level	-4.420**	-1.529**	-4.391**	-1.757**
	(1.005)	(.347)	(1.003)	(.120)
Education:				
Elementary school	0.068**	0.023**	0.067**	0.026**
	(.022)	(.008)	(.022)	(.003)
Junior high school	0.037	0.013	0.038	0.014
	(.027)	(.009)	(.027)	(.003)
High school	0.053	0.018	0.054	0.019
	(.033)	(.011)	(.032)	(.004)
College degree	0.007	0.002	0.009	0.000
	(.035)	(.012)	(.035)	(.004)
University degree	0.210**	0.069**	0.211**	0.069**
	(.037)	(.011)	(.037)	(.004)
Graduate/professional degree	0.649**	0.179**	0.646**	0.190**
	(.079)	(.016)	(.079)	(.009)
Wife's education:				
Elementary school	-0.005	-0.002	-0.005	-0.004
	(.014)	(.005)	(.014)	(.002)
Junior high school	0.014	0.005	0.014	0.003
	(.024)	(.008)	(.024)	(.003)
High school	0.072**	0.024**	0.071**	0.026**
	(.028)	(.009)	(.028)	(.003)
College degree	-0.171**	-0.062**	-0.170**	-0.046**
	(.044)	(.017)	(.044)	(.005)
University degree	-0.207**	-0.075**	-0.208**	-0.064**
	(.050)	(.019)	(.050)	(.006)
Graduate/professional degree	-0.076	-0.027	-0.067	0.001
	(.146)	(.052)	(.145)	(.017)
Age	-0.113**	-0.039**	-0.113**	-0.043**
	(.003)	(.001)	(.003)	(.000)
Wife's age	0.012**	0.004**	0.012**	0.003**
	(.002)	(.001)	(.002)	(.000)
Number of children	0.018**	0.006**	0.018**	0.006**
	(.005)	(.002)	(.005)	(.001)
Constant	5.947**		5.857**	
	(.142)		(.150)	
ρ			0.070**	
			(.340)	
Number of observations	51730		51730	

Note: The dependent variable is husband's participation in the labor force. Standard errors are in parentheses. Full sets of year dummies and county dummies are included in the models. ** is a 5% significant level.

Table 4 Results of Oaxaca Decomposition

	OLS	Probit
Participation rate, 2008	0.627	0.626
Participation rate, 1988	0.711	0.711
Total change	-0.084	-0.084
Effect of :		
Change in men's characteristics	0.001	0.002
	-1.38%	-2.28%
Change in wives' characteristics	0.000	0.001
	-0.59%	-0.99%
Change in wives' participation	0.015	0.016
	-17.94%	-19.05%
Change in family status	0.000	-0.001
	0.005%	1.33%
Change in unemployment rate	-0.056	-0.056
	66.42%	66.51%
Unexplained	-0.045	-0.046
	53.49%	54.48%

Note: The dependent variable is husband's participation in the labor force. Men's characteristics include husband's age and education dummies. Women's characteristics include wife's age and education dummies. Family status represents numbers of child.

Table 5 Results of DiNardo-Fortin-Lemieux Decomposition

	(1)	(2)
Predicted Participation rate, 2008	0.626	0.584
Predicted Participation rate, 1988	0.712	0.681
Total change	-0.085	-0.097
Effect of :		
Change in unemployment rate	-0.035	-0.039
	41.14%	40.54%
Change in characteristics	0.000	-0.004
	0.52%	3.62%
Change in wives' participation	0.016	0.008
	-18.52%	-8.41%
Unexplained	-0.066	-0.062
	76.86%	64.25%

Note: The dependent variable is husband's participation in the labor force. Men's characteristics include husband's age and education dummies Women's characteristics include wife's age and education dummies.