



Full-time, part-time employment and life satisfaction of the elderly

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ABSTRACT

There is continued interest in employment and subjective well-being among the elderly because of the increasing proportion of elderly population in the labor force. This study investigates the association between part-time and full-time employment and life satisfaction of the elderly in Taiwan. We also examine how these associations may differ across socio-demographic groups. An ordinal treatment effect model is developed to accommodate the discrete feature of the employment decision and the potential endogeneity of these two outcomes. Using a unique sample of the elderly in Taiwan, in contrast to findings for the general population of the previous studies, we find that part-time employment is significant and positively associated with life satisfaction, while elderly with full-time employment have lower life satisfaction. These results are robust across socio-demographic groups.

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1. Introduction

The increasing proportion of the elderly in the population has been a common phenomenon in developed countries. In OECD countries, the percentage of population age 65 and above was 14.4% in 2008 and is expected to reach 25% in 2050 (OECD, 2010). An aging population is found in Taiwan as well. Data from the 2009 Taiwan Statistical Data Book suggest that the percentage of the elderly increased from 4.3% in 1980 to 10.4% in 2008 (DGBAS, 2009). In the mean time, the labor force participation rate among individuals age 60 and above also dramatically increased over the past thirty years, from 3.7% in 1980 to 4.6% in 2010 (at approximately 24%). Given the fact that, in many economies, people need to work longer to support themselves, it is crucial to know if employment has any effect on life satisfaction. On the other hand, the elderly are generally believed to be more vulnerable to health disorders, especially mental illness. With the growing proportions of the elderly in the labor force in Taiwan as well as in other countries, a better understanding of the association between employment status and the subjective well-being of the elderly is of policy interest.

Life satisfaction has been shown in sociological studies as a reliable indicator of subjective well-being (e.g., Richardson and Kilty, 1991; Scheier and Carver, 1992; Reis and Pushkar-Gold, 1993;

Koivumaa-Honkanen et al., 2000; Kim and Moen, 2001; Wu et al., 2005; Collins et al., 2009). Life satisfaction reflects quality of life judgments that are based on individuals' own criteria for success and happiness, and its measures vary in their composition, but generally, they tap trait levels of effect as well as cognitive assessments of the extent to which a person's life matches his or her expectations (Okun and Stock, 1987). In life satisfaction surveys, respondents are typically asked a series of questions to reflect on how their lives compare to their ideals, whether or not they find their lives interesting, how satisfied they are with their lives, and whether or not they would change anything about their lives. A considerable number of sociological studies have focused on this issue. However, how employment status may influence the subjective well-being of the elderly has remained the subject of much debate in sociological studies. Some studies argue that employment plays a fundamental role central to an individual's identity and, therefore, people who retired from the labor force are expected to lose their roles and such loss could lead to severe psychological distress (e.g., Kim and Moen, 2001). Others point out that retired people may have a discontinuity of the central role in the community and, consequently, may be more likely to have mental disorders if they cannot find other activities to replace their roles in their previous jobs (Richardson and Kilty, 1991). On the other hand, a positive relationship between retirement and psychological well-being has also been suggested. Some studies stated that retirement may be beneficial to the elderly subjective well-being in that these retirees have more time to develop new interests or hobbies or spend more time with their families (Wu et al., 2005).

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Studies on the impacts of employment on subjective well-being have also existed in the economic literature (e.g., Di Tella et al., 2001; Charles, 2004; Frijters et al., 2004; Andersson, 2008). Using macro-level data, Di Tella et al. (2001) found that people are happier when the unemployment rate is low. Unemployment has also been found associated with substantial negative non-pecuniary effects, such as increased suicide risk and crime rates (Jensen and Smith, 1990). Using the Health and Retirement Study in the United States (US), Dave et al. (2008) find that complete retirement leads to a 4–6% increase in illness, and a 6–9% decline in mental health of the elderly. Winkelmann and Winkelmann (1998) also find a negative relationship between unemployment and subjective well-being. Stutzer (2004) finds a negative association between retirement and life satisfaction, suggesting that retirement may imply more time on household duties which are associated with reduced well-being.

While there is a consensus among previous studies on the role of employment status in life satisfaction, the differentiated effects of employment status categories have been underexplored in the literature. Most existing studies did not distinguish between the effects of part-time and full-time work on subjective well-being.¹ People who are employed part-time may have different purposes and perspectives about life than those who have a full-time job. For instance, many people may choose to work part-time for its fringe benefits, such as health insurance coverage. In contrast, people who work for a full-time job may do so to make a living. Therefore, part-time and full-time employment may have different influences on subjective well-being. In addition, only a few studies have addressed the potential endogeneity between employment and life satisfaction. The endogeneity issue is important since Dave et al. (2008) point out that retirement and mental health of the elderly in the US that are correlated to each other due to unobserved common characteristics. For instance, people who are more risk averse may have higher propensity to work to ensure their living standard. On the other hand, they may have lower life satisfaction since they may worry too much about their health than others. Since risk preference is usually unobserved in the data, this unobserved common factor then results in the endogeneity between employment decision and life satisfaction. Therefore, failure to control for unobserved interrelation between employment and mental health will lead to biased empirical estimates and policy inference. Moreover, most empirical evidence from previous studies relied on data from the US and European countries, and relatively little is known about the role of employment in life satisfaction in Asian countries.

Using a national representative sample of the elderly in Taiwan, this study examines the association between employment and life satisfaction. Our study differs from previous studies in two important ways. First, elderly with part-time employment, full-time employment, and those without employment are distinguished. We also examine whether the association between part-time (full-time) employment and life satisfaction may differ across socio-demographic groups. Moreover, we account explicitly for the potential endogeneity between employment decision and subjective well-being by developing an ordinal treatment effect model and estimate it with the maximum-likelihood method. Our findings suggest that it is important to distinguish between part-time and full-time employment because we find that full-time employment is negatively correlated with life satisfaction. In contrast, elderly with part-time jobs have better life satisfaction compared to their counterparts without employment. The positive associations are

more pronounced for elderly who are male and with higher education.

The rest of the paper is organized as follows. We first describe the data used in the analysis. An ordinal treatment effect econometric model is then developed. We then present the empirical results and summarize the findings.

2. Data

Data used in this study are drawn from the 2003 Survey of Health and Living Status of the Elderly (SHLSE), conducted by the Department of Health in Taiwan. The sample is representative of the old age population in Taiwan, and the response rate was over 90%. Further details on sample design and data collection process are available in the survey documentations (TDH-BHP, 2008).² The objective of this survey was to understand the general health conditions among the elderly. Thus, detailed information on physical conditions, history of chronic diseases, and life satisfaction of each individual was collected, as was information on socio-demographic characteristics, lifestyles, and social interactions. Although current employment status is available, not much information was collected on wages, incomes, or assets, and many responses were missing on the income question. In total, 3773 adults age 57 and above were included for face-to-face interviews. After deleting observations with missing values on employment status and key socioeconomic variables, the final sample consists of 3182 adults.

The first endogenous variable is employment status. In the survey, each respondent was asked about their current employment status, and the response to this question falls into three categories: currently not employed, currently employed for a part-time job, and currently working for a full-time job. Of the respondents who reported working part-time or full-time, complete work hour information was recorded for less than one-third of the working respondents. Accordingly, we focus on the dichotomous information on employment and define an ordinal variable for each individual's work status, with a value 0 indicating currently without employment, 1 for working part-time, and 2 for working full-time.

The other endogenous variable is an index of life satisfaction. In SHLSE, 12 questions were asked which reflect different aspects of life satisfaction including zest, apathy, resolution and fortitude, congruency, and self-concept or mood tone. These questions were adopted from the Life Satisfaction Index-A (LSIA), originally proposed by Neugarten et al. (1961), and modified for use with the Taiwanese respondents. Respondents were asked if they “agreed” or “disagreed” to the statement in each question, with response coded as 1 and 0, respectively. A life satisfaction index is then constructed as the sum of these binary responses which ranges from 0 to 12, with a larger value of the index indicating a larger degree of life satisfaction.³ This index was shown to be a reliable measure of life satisfaction of old residents in Taiwan (Chen, 2001).

Drawing on the literature of employment and subjective well-being among the elderly (e.g., Campolieti, 2000; Cassidy et al., 2004; Lee and Shinkai, 2005; Chatterji et al., 2007), several categories of explanatory variables are used, which include individual characteristics, lifestyle behaviors, household and family features, social interactions, and local economic conditions. Individual characteristics include age and gender. Age and its squared terms are used to explain employment and life satisfaction. Dummy variables are also included to accommodate differences by gender and education levels. Chronic health condition has been shown to be an

¹ An exception is found in a study by Booth and van Ours (2008) in Britain, in which part-time employment and life satisfaction were examined. They find no difference in the association between employment and life satisfaction between males and females.

² SHLSE has been utilized in several studies and the quality of the dataset has been recognized (e.g., Chen et al., 2007; Collins et al., 2009; Tsai et al., 2006).

³ Descriptions of the 12 questions and construction of the LSIA index are detailed in Appendix A.

important determinant of the labor supply decision and life satisfaction (Smith, 1999). A continuous variable (diseases) is therefore constructed as the sum of affirmative responses to chronic health conditions with 10 common chronic symptoms among the elderly, including diabetes, cancer, hypertension, cardiopathy, apoplexy, bronchitis, gastric ulcer, gout, liver disease, and bone fracture. The value of the variable ranges from 0 to 10, with a higher value indicating worse health history. This variable is defined from historical records and does not necessarily reflect current health conditions.

Three dummy variables are also included to reflect lifestyle behavior. A smoker is defined as one who smokes at least one cigarette per day, and current drinker as one who drink alcohol at least once a week. In addition, a dummy variable is defined if the individual exercises regularly, at least once per week. Because household and family characteristics may be associated with employment status and life satisfaction of the elderly, a dummy variable indicating babysitting of grandchildren is also included. Since income support from other family members is important of employment status and subjective well-being among the elderly in Taiwan (e.g., Lyu and Lin, 2000), a dummy variable is therefore included indicating if the individual has received monthly money support from his/her children. Since previous studies have shown correlations between social activity/support and retirement decision with mental health among the elderly (Horsten et al., 2000), two variables are used to indicate if the individual participates in social work, such as monthly entertainment programs in the community, and if the individual works for public social service as a volunteer worker.

Important efforts have been made to identify the role of peer influence on individual employment decision (e.g., Araujo et al., 2010). Although the SHLSE data contain information on health and employment, information is lacking on details of the social interaction of elderly employments. To capture the network or peer effects on the employment decisions among the elderly, the percentage of the employed elderly over the total elderly in the local area is collected. These extraneous data are aggregated to the county level from data collected by the Bureau of Economic Analysis' employment files, and aggregated to the county level in 2003. Importantly, this variable also serves as an important identification variable in estimating the model (discussed below). Detailed definitions and sample statistics of all explanatory variables are presented in Table 1 by employment status.

As exhibited in Table 1, 2641 out of 3812 (83%) elderly are without employment. Among the 17% of employed persons, 3% are employed part-time and 14% full-time. The average life satisfaction score also differs by employment statuses. The highest score is found among the full-time workers (8.58 score points), and the lowest among the elderly without employment (8.08 score points). Compared to the elderly without employment, the average life satisfaction scores of the full-time and part-time workers are 6.19% and 0.87% higher, respectively. Differences in life satisfaction by employment statuses are revealed in other exogenous variables as well. Old adults currently working full-time tend to be younger, of less severity with chronic disease, and of higher education; they also have less financial support from their children.

3. Econometric model

To investigate the association between employment status and life satisfaction of the elderly, we develop a treatment effect model for a continuous outcome variable (y_i) for life satisfaction with an ordinal endogenous treatment variable (d_i), for individual i . There is a large body of literature in the use of treatment effect model in evaluation of programs (Barnow et al., 1980). An important econometric issue in such program evaluation is endogenous selection

of the subjects (individuals) into the treated and untreated states which, if not accommodated, can lead to sample selectivity bias. Conventional treatment effect models feature a continuous outcome variables with a binary endogenous treatment variable(s). Our model differs slightly from this existing framework in that the treatment variable is not binary but ordinary. This is accomplished by including a set of binary endogenous indicator variables (h_i) associated with the ordinal endogenous variable (d_i) as explanatory variables. Employment status, an ordinal treatment variable, is modeled with ordered probit (McKelvey and Zavoina, 1975):

$$\begin{aligned} d_i &= 0 \quad \text{if} \quad -\infty \leq z_i'\alpha + u_i < 0 \\ &= 1 \quad \text{if} \quad 0 \leq z_i'\alpha + u_i < \mu \\ &= 2 \quad \text{if} \quad \mu \leq z_i'\alpha + u_i < \infty, \end{aligned} \quad (1)$$

where $d_i = 0$ for no employment, $d_i = 1$ for part-time employment, and $d_i = 2$ for full-time employment. The continuous life satisfaction outcome (y_i) is captured with a linear regression equation with the endogenous employment indicators (h_i) as regressors:

$$y_i = x_i'\beta + h_i'\delta + v_i. \quad (2)$$

In Eqs. (1) and (2), z_i and x_i are vectors of exogenous variables in the employment decision and life satisfaction equations respectively, and $h_i = [h_{1i}, h_{2i}]'$ such that $h_{1i} = 1$ if $d_i = 1$, $h_{2i} = 1$ if $d_i = 2$, and zero otherwise, with no employment ($d_i = 0$) as the reference category. The parameters include vectors α , β , and δ and the threshold scalar μ . The error terms (u_i, v_i) are assumed to be bivariate normal distribution with zero means, variances (1, σ^2), and correlation ρ .

To describe the estimation procedure, denote the probability density function of the univariate standard normal distribution as $\phi(\cdot)$ and the cumulative distribution function as $\Phi(\cdot)$. Then, the likelihood contribution for a sample of n observations is

$$\begin{aligned} L &= \prod_{i=1}^n \frac{1}{\sigma} \phi \left(\frac{y_i - (x_i'\beta + h_i'\delta)}{\sigma} \right) \\ &\times \prod_{d_i=0} \left\{ \Phi \left[\frac{-z_i'\alpha - \rho(y_i - x_i'\beta - h_i'\delta)/\sigma}{(1 - \rho^2)^{1/2}} \right] \right\} \\ &\times \prod_{d_i=1} \left\{ \Phi \left[\frac{(\mu - z_i'\alpha) - \rho(y_i - x_i'\beta - h_i'\delta)/\sigma}{(1 - \rho^2)^{1/2}} \right] \right. \\ &\quad \left. - \Phi \left[\frac{-z_i'\alpha - \rho(y_i - x_i'\beta - h_i'\delta)/\sigma}{(1 - \rho^2)^{1/2}} \right] \right\} \\ &\times \prod_{d_i=2} \left\{ 1 - \Phi \left[\frac{(\mu - z_i'\alpha) - \rho(y_i - x_i'\beta - h_i'\delta)/\sigma}{(1 - \rho^2)^{1/2}} \right] \right\}. \end{aligned} \quad (3)$$

The likelihood function suggests that the likelihood contribution of individual i is the product of the normal probability density function in the first line and the probability in the second, third, or fourth line depending on outcome of the employment variable (d_i). Maximum-likelihood estimation proceeds by maximizing the logarithm of the likelihood function, that is, by finding the values of parameters α , β , δ , and μ which make the log-likelihood function the maximum. This is accomplished by programming the likelihood function (Eq. (3)) using the numerical optimization package "maxlik" in Gauss software (Aptech, 1997). Note that by restricting the error correlation (ρ) at 0, the sample likelihood function simplifies to two components: one for the ordinal probit model (for d_i) and the other for the linear regression model (for y_i). In this case, the likelihood function is separable in two sets of parameters (α, μ) and (β, δ, σ), and the model can be estimated by maximum-likelihood for ordered probit for d_i , and linear regression for y_i , with exogenous dummy variables h_{1i} and h_{2i} . Endogeneity of treatment variables h_{1i} and h_{2i} can be

Table 1
Variable definitions and sample means by employment category.

Variable	Definition	Without employment	Employed part-time	Employed full-time
Continuous variables				
Life satisfaction	Score of satisfaction about life (0–12) (endogenous variable)	8.08 (3.05)	8.15 (2.92)	8.58 (2.61)
Age	Age in years	72.00 (7.99)	65.85 (6.67)	64.11 (6.45)
Diseases	Score of chronic diseases (0–10): sum of binary indicators of all (10) diseases	2.61	2.03	1.60
Percent employed	Proportion of the elderly employed (county level)	(1.99) 0.14 (0.04)	(1.98) 0.16 (0.04)	(1.64) 0.15 (0.04)
Binary explanatory variables (yes = 1; no = 0)				
Male	Gender is male	0.49	0.67	0.74
Primary school	Had primary school or less (reference)	0.76	0.81	0.70
Junior high	Finished junior high school	0.10	0.06	0.11
Senior high	Finished senior high school	0.08	0.07	0.11
College	Finished college or higher	0.06	0.06	0.08
Married	Married	0.64	0.81	0.85
Smoker	Currently smoking cigarettes	0.18	0.29	0.28
Drinker	Drinking alcohol	0.22	0.38	0.42
Babysitting	Baby sitting grandchildren	0.18	0.27	0.17
Money support	Received monetary support from children	0.55	0.40	0.31
Exercise	Exercise at least once a week	0.70	0.58	0.52
Social service	Participated in social service work	0.42	0.55	0.51
Volunteer work	Participated in volunteer work	0.07	0.18	0.11
Unemployed	Individual is unemployed	1.00	0.00	0.00
Part-time	Individual is employed part-time	0.00	1.00	0.00
Full-time	Individual is employed full-time	0.00	0.00	1.00
Sample size (%)		2641 (83%)	102 (3%)	439 (14%)

Standard deviations are in parentheses.

investigated by testing for significance of the error correlation (ρ), using the likelihood-ratio (LR) and Wald tests (Engle, 1984).

The roles of continuous (discrete) exogenous variables can be examined by differentiating (differencing) relevant probability and conditional mean expressions. Based on normality of the error term u_i , the marginal probabilities of d_i being in the three categories are

$$\begin{aligned}\Pr(d_i = 0) &= \Phi(-z'_i\alpha) \\ \Pr(d_i = 1) &= \Phi(\mu - z'_i\alpha) - \Phi(-z'_i\alpha) \\ \Pr(d_i = 2) &= 1 - \Phi(\mu - z'_i\alpha).\end{aligned}\quad (4)$$

The conditional means of life satisfaction (y_i) given different employment status are

$$\begin{aligned}E(y_i|d_i = 0) &= x'_i\beta + h'_i\delta - \rho\sigma \left\{ \frac{\phi(-z'_i\alpha)}{\Phi(-z'_i\alpha)} \right\} \\ E(y_i|d_i = 1) &= x'_i\beta + h'_i\delta - \rho\sigma \left\{ \frac{\phi(\mu - z'_i\alpha) - \phi(-z'_i\alpha)}{\Phi(\mu - z'_i\alpha) - \Phi(-z'_i\alpha)} \right\} \\ E(y_i|d_i = 2) &= x'_i\beta + h'_i\delta - \rho\sigma \left\{ \frac{-\phi(\mu - z'_i\alpha)}{1 - \Phi(\mu - z'_i\alpha)} \right\}.\end{aligned}\quad (5)$$

Marginal effects of explanatory variables can be derived by differentiating (and differencing, in the case of a discrete variable) (Eqs. (4) and (5)).

The effects of employment on life satisfaction measure (y_i) can be explored further by calculating the average treatment effects

based in Eq. (5), for sample observations in entire sample or subgroups:

$$ATE_{k,\ell} = E(y_i|d_i = k; z_i, x_i) - E(y_i|d_i = \ell; z_i, x_i), \quad \text{for } k > \ell. \quad (6)$$

Then, following Heckman et al. (2003), average treatment effects (ATEs) can be calculated by taking the means of $ATE_{k,\ell}$ over the sample observations. As seen in Eq. (5), the treatment effects depend on coefficients (δ) of the treatment dummy variables (h_i) as well as the error correlation (ρ) and all coefficients (α) from the employment equation. This stands in contrast to the treatment effects for the naïve (exogenous treatment) model in which case the treatment effects depend merely on coefficients of the treatment variables (δ). For statistical inference, standard errors of the marginal and treatment effects can be derived by the δ -method (Rao, 1973).

We calculated the average treatment effects for part-time ($d_i = 1$) and full-time ($d_i = 2$) elderly workers in reference to the reference group of the workers without employment ($d_i = 0$), as well as for full-time ($d_i = 2$) in reference to part-time ($d_i = 1$). To further explore how the average treatment effects may differ by socio-demographic characteristics, we also calculate the treatment effects by socio-demographic subgroups in addition to the entire sample.

4. Results and discussion

Our empirical results are presented in several sets. Table 2 presents the maximum-likelihood estimates for the employment and life satisfaction equations. The effects on life satisfaction due to different employment status are calculated and presented in

Table 2

Maximum-likelihood estimates of life satisfaction with ordinal employment status.

Variable	Employment		Life satisfaction	
	Estimate	S.E.	Estimate	S.E.
Constant	9.043***	2.350	−0.748	3.882
Diseases	−0.080***	0.018	−0.211***	0.028
Age/10	−2.257***	0.682	1.382	1.074
Age ² /1000	1.075**	0.489	−0.511	0.743
Junior high	−0.104	0.101	0.622***	0.156
Senior high	−0.244**	0.104	0.862***	0.170
College	−0.170	0.132	0.980***	0.181
Married	0.144*	0.077	0.662***	0.124
Smoker	−0.172**	0.077	0.073	0.139
Drinker	0.192***	0.069	0.200*	0.122
Babysitting	−0.316***	0.078	0.395***	0.134
Money support	−0.454***	0.063	0.435***	0.110
Exercise	−0.466***	0.062	1.307***	0.123
Male	0.677***	0.077	−0.494***	0.135
Volunteer work	0.006	0.093	0.721***	0.168
Social service	0.184***	0.063	0.592***	0.108
Percent employed	3.440***	0.775		
Threshold (μ)	0.185***	0.018		
Part-time			2.012***	0.436
Full-time			1.052***	0.403
Error std. dev. (σ)			2.838***	0.038
Error corr. (ρ)			−0.270***	0.076
Log likelihood	−9114.212			

Standard errors are calculated from the robust covariance matrix.

*** Significance at the 1% level.

** Significance at the 5% level.

* Significance at the 10% level.

Table 3. Marginal effects of exogenous variables on employment decision and life satisfaction are presented in Table 4.

4.1. Justification of the model specification

We first explain the issue of parameter identification. One important empirical issue in estimation of treatment effect models is the use of exclusion restrictions to identify the model parameters. For conventional instrumental variables estimation, parameter identification requires at least one variable that is correlated with the endogenous variable, uncorrelated with the error terms of the outcome equation, and is not directly associated with the outcome variable. For maximum-likelihood estimation of the current model, however, the nonlinear identification criteria are met

without exclusion restrictions owing to the distributional assumption for the error terms. Nonlinear functional form inherent in the distributional assumption, however, often fails to generate sufficient variation to identify the model parameters so it may be capricious to rely solely on distributional assumptions for identification (Maddala, 1983). To avoid over-burdening the nonlinear functional forms for parameter identification, we impose an exclusion restriction. Specifically, a unique variable is included in the employment equation but not in the life satisfaction equation. It is the percentage of the employed elderly over the total number of elderly in the county level (discussed above). This variable captures the potential network or peer influences on employment decision among the elderly, and the importance of peer influence on employment decision has been found in Araujo et al. (2010). It is posited

Table 3

Estimated average treatment effects of employment on life satisfaction.

Group	Sample size	Part-time vs. not employed	Full-time vs. not employed	Full-time vs. part-time
Full sample	3182	0.749*** (0.167)	−0.653* (0.372)	−1.402*** (0.415)
Male	1673	0.932** (0.190)	−0.515 (0.345)	−1.448** (0.425)
Female	1509	0.545*** (0.166)	−0.806** (0.406)	−1.351*** (0.404)
≤Primary school	2395	0.723*** (0.166)	−0.672* (0.376)	−1.395*** (0.413)
>Primary school	787	0.826*** (0.176)	−0.596* (0.361)	−1.422*** (0.419)
Age ≤ 64	936	1.151*** (0.232)	−0.372 (0.322)	−1.523*** (0.441)
65 ≤ Age ≤ 70	607	0.864*** (0.179)	−0.544 (0.350)	−1.408** (0.416)
71 ≤ Age ≤ 80	1247	0.543*** (0.165)	−0.798** (0.403)	−1.340*** (0.402)
Age > 80	392	0.265 (0.210)	−1.036** (0.465)	−1.301*** (0.394)

Asymptotic standard errors in parentheses.

*** Significance at the 1% level.

** Significance at the 5% level.

* Significance at the 10% level.

Table 4

Marginal effects of explanatory variables on the probabilities of employment categories and life satisfaction level conditional on employment category.

Variable	Probabilities of employment categories			Life satisfaction conditional on employment		
	Not employed	Part-time	Full-time	Not employed	Part-time	Full-time
Continuous explanatory variables						
Diseases	0.013*** (0.003)	−0.003 (0.003)	−0.010*** (0.003)	−0.227*** (0.027)	−0.272** (0.126)	−0.263*** (0.044)
Proportion employed	−0.559*** (0.123)	0.130** (0.031)	0.429*** (0.095)	0.714*** (0.252)	2.626*** (0.918)	2.245*** (0.786)
Binary explanatory variables						
Age/10	0.120*** (0.010)	−0.028*** (0.003)	−0.092*** (0.009)	0.506*** (0.074)	0.096 (0.135)	0.178 (0.114)
Junior high	0.016 (0.015)	−0.004 (0.004)	−0.012 (0.011)	0.602*** (0.171)	0.543*** (0.178)	0.554*** (0.175)
Senior high	0.034*** (0.013)	−0.008** (0.003)	−0.026*** (0.010)	0.816*** (0.188)	0.675*** (0.198)	0.701*** (0.194)
College	0.025 (0.016)	−0.006 (0.004)	−0.019 (0.012)	0.947*** (0.214)	0.850*** (0.221)	0.868*** (0.218)
Married	−0.023** (0.012)	0.005* (0.003)	0.017** (0.009)	0.691*** (0.118)	0.772*** (0.129)	0.757*** (0.125)
Smoker	0.026** (0.011)	−0.006** (0.003)	−0.020** (0.008)	0.039 (0.140)	−0.058 (0.147)	−0.039 (0.144)
Drinker	−0.033*** (0.013)	0.007*** (0.003)	0.026*** (0.010)	0.241* (0.126)	0.346*** (0.131)	0.324*** (0.128)
Babysitting	0.045*** (0.010)	−0.011*** (0.003)	−0.034*** (0.007)	0.337*** (0.136)	0.154 (0.146)	0.187 (0.142)
Money support	0.075*** (0.011)	−0.017*** (0.003)	−0.058*** (0.009)	0.340*** (0.103)	0.089 (0.128)	0.140 (0.118)
Exercise	0.084*** (0.013)	−0.018*** (0.003)	−0.066*** (0.011)	1.202*** (0.110)	0.951*** (0.129)	1.005*** (0.120)
Male	−0.109*** (0.013)	0.025*** (0.004)	0.084*** (0.011)	−0.355*** (0.126)	0.022 (0.172)	−0.052 (0.156)
Volunteer work	−0.001 (0.016)	0.000 (0.004)	0.001 (0.012)	0.722*** (0.195)	0.726*** (0.198)	0.725*** (0.197)
Social service	−0.030*** (0.011)	0.007*** (0.003)	0.023*** (0.008)	0.631*** (0.107)	0.733*** (0.114)	0.712*** (0.111)

Asymptotic standard errors in parentheses.

*** Significance at the 1% level.

** Significance at the 5% level.

* Significance at the 10% level.

that peer influence is directly associated with the employment decision due to the shared information regarding job availability; while its association with life satisfaction would be remote at best, if at all, and this hypothesis is tested below. The variable indicating the percentage of employed elderly is used as the instrument of the employment status on life satisfaction. As presented in Table 2, the instrument is significant at the 1% level of significance. Importantly, this identification strategy is further supported with a former statistical test. To test for the weak instrument (i.e., whether the identification variable is not explaining employment decision), we estimate a single ordered probit model (Eq. (1)) and test for significance of the instrument with LR and Wald tests. The hypothesis of weak instruments is rejected (LR = 24.93, Wald = 24.59, df = 1, p -value < 0.0001). These tests are similar in spirit to that suggested by Staiger and Stock (1997) for more conventional statistical models.

In what follows, we discuss the results in Table 2 with the error correlation (ρ) between (the error terms of) the employment and life satisfaction equations, which equals −0.270 and is significant at the 1% level of significance. Significance of the error correlation is further confirmed by a LR test (LR = 6.08, df = 1, p -value = 0.014). Significance in the error correlation indicates that employment decision and subjective well-being are inter-correlated due to some common unobserved factors. Because the two equations are endogenous to each other, a joint estimation of the two equations can improve statistical efficiency and ameliorate simultaneous equation biases in the other parameter estimates. This negative error correlation may be driven by many mechanisms. One possibility may be the different value systems of the elderly regarding

material life and leisure. People who value leisure time higher than the material quality of life may have better life satisfaction, and they may also have less incentive to work. Therefore, a negative association between employment and life satisfaction is possible.

To further investigate the cost of the estimation bias when simultaneity between employment decision and life satisfaction is not considered, a restricted (independent) model is also estimated with the procedure described above. This independent model implies that the employment decision is exogenous to the life satisfaction equation. Thus, the life satisfaction equations is estimated by the ordinary least square (OLS) method and the estimation results are presented in Appendix A. As shown in Table A1, one of the key variables, full-time employment, is insignificant (0.121, S.E. = 0.290) while results of the simultaneous equation system suggest a notably different estimate (1.052) for the coefficient of that variable which is significant at 1% level (Table 2). This result indicates that ignoring the simultaneous relationship between employment decision and life satisfaction can cause biased results for the effect of key variables—effect of employment in this case.

The empirical specification can be further justified by significance of the exogenous variables. Of the 16 regressors in the employment equation, 12 are significant at the 5% level of significance and 1 at the 10% level. Estimate for the threshold parameter (μ) is significant at the 1% level, justifying categorization of employment into three (vs. two) categories. Statistical significance of the life satisfaction equation is only slightly more scant, with 12 of the 16 variables significant at the 10% level of significance or lower. We defer further discussion of the association between the explanatory variables and life satisfaction.

Table A1

Ordinary least-squares estimates of life satisfaction with employment status dummy variables.

Variable	Estimate	S.E.
Constant	4.925	3.626
Diseases	−0.229***	0.026
Age/10	0.068	1.023
Age ² /1000	0.266	0.712
Junior high	0.585***	0.171
Senior high	0.795**	0.189
College	0.921***	0.215
Married	0.678***	0.118
Smoker	0.026	0.141
Drinker	0.276**	0.126
Babysitting	0.290**	0.136
Money support	0.321***	0.103
Exercise	1.158**	0.109
Male	−0.324**	0.127
Volunteer work	0.727***	0.196
Social service	0.649***	0.107
Part-time	0.625***	0.164
Full-time	0.121	0.290
Standard error (σ)	2.838***	
R ²	0.121	
F _(17,3164)	25.696	
Sample size	3182	
Log likelihood	−7796.818	

*** Significance at the 1% level.

** Significance at the 5% level.

4.2. Association between employment decision and life satisfaction

The most important findings are the association between employment status and life satisfaction. As presented in Table 2, the coefficients of the full-time and part-time employment in the life satisfaction equation are both statistically significant at the 1% level. To understand further how these effects may differ across socio-demographic groups, we calculate the average treatment effects (ATEs) not only for the whole sample, but also for groups of individuals by gender, education, and age. Results in Table 3 generally indicate that distinguishing between part-time and full-time employment is worthwhile. Part-time and full-time employment are associated with life satisfaction among the elderly in different ways, and these associations are significant for almost all of the socio-demographic groups. In general, compared to unemployed elderly, those who have part-time work have higher life satisfaction, other things being equal. The significant association between part-time employment and life satisfaction of the elderly differ from findings in the literature for the general population. For instance, Brereton et al. (2008), find that part-time employment is negatively associated between life satisfaction among adults in Ireland. However, our finding of the positive correlation between part-time employment and life satisfaction among the elderly is not unexpected. One reason for the positive association may be that the primary purpose of the elderly to work is different compared to their young counterparts. A part-time job can bring opportunities for interactions with their peer groups, while providing an alternative source of their time allocation. In addition, unlike the full-time works, part-time works have less duty or stress on job assignments. As a result, their life satisfaction can be increased by working part-time.

The positive association between part-time employment and life satisfaction are also evident across gender, education, and age subgroups. For instance, a stronger correlation is found for male part-time workers compared to their counterparts without employment (0.932). This result may reflect the fact that given the social structure in most Asian countries, including Taiwan, in which most husbands are the breadwinners who have to work for

full-time to support the family. Other things being equal, their life satisfaction can be improved if they can work part-time with less liability of the job. Our finding is similar to those in European countries. For instance, van Praag and Ferrer-I-Carbonell (2001) find that employment affects men's subjective well-being more than women in Germany.

A strong association is also evident for part-time elderly workers with higher education. Results show that the life satisfaction score of the full-time workers who have at least primary school education is 0.103 point higher than their counterparts who only had primary education (0.826 vs. 0.723). This finding may reflect the possibility that elderly with higher education have more options to choose their part-time jobs. Therefore, part-time workers with better education have higher life satisfaction compared to those part-time workers with less education.

Interesting findings are also found across age groups. The significant and positive association between part-time employment and life satisfaction are evident for elderly age ≤ 64 and age 65–70. Compared to their counterparts without employment, adults younger than 65 and age 65–70 have higher life satisfaction by 1.151 and 0.864 point, respectively. In contrast, insignificant associations are observed for those who are older than 80 years old. This result may indicate the possibility that workers usually face retirement around age 65 in the public or government sectors, and those who are older than 65 years old are forced into retirement. On the other hand, workers age ≤ 64 have options to work or retire from the labor market. Therefore, continuing working reflects their optimal choices and thus increase their life satisfaction.

Full-time employment, in contrast, is negatively correlated with life satisfaction. Compared to individuals who are without employment, the life satisfaction score for full-time workers is 0.653 lower according to the whole sample. This result confirms the belief and theory from the psychological science that full-time employment results in stress which subsequently contributes to mental illness (e.g., Jensen and Smith, 1990). This finding is also in agreement with the belief that retirees have more time to develop new interests or hobbies or spend more time with their families (Wu et al., 2005). However, our finding differs from those of previous studies which examine the influence of unemployment on psychological well-being on the general population. For instance, using a macro-level time series data, Jensen and Smith (1990) find substantial impacts of unemployment on adverse individual outcomes such as decreased marital stability, suicide risk, and crime rates. Winkelmann and Winkelmann (1998) also find a negative relationship between unemployment and subjective well-being.

4.3. Other determinants of the employment decision

Though not the primary emphasis of this study, the association between the exogenous variables and employment status of the elderly are explored, by calculating the marginal effects of these variables on the probability of being not employed, part-time employed, and full-time employed (Table 4). Echoing findings in the labor supply literature, the significant determinants of employment status are individual characteristics, social interaction, and family condition.

With respect to human capital, age is negatively associated with the likelihood of employment as expected. A 10 year increase in an individual's age decreases the likelihood of working part-time and full-time by 2.8% and 9.2% respectively. Education is also correlated with the employment decision of the elderly. However, unlike findings reported in the literature for the general population, a negative correlation between education and employment decision is evident. Compared to those with only primary school education, old

adults who had finished senior high school are 3.4% more likely to be without employment and 0.8% (2.6%) less likely to be employed part-time (full-time). The life cycle hypothesis offers one possible explanation for these negative associations between education and employment. That is, older people with better education are more likely to have higher salary or return of human capital on the job market than those with less education, and consequently can afford to retire at an earlier stage of their lives.

Similar to findings for elderly in the US (e.g., Schirle, 2008), gender difference is also evident. Compared to their female cohorts, elderly male adults are 2.5% and 8.4% more likely to work part-time and full-time, respectively. Lifestyles are also associated with employment status. Alcohol drinkers are 0.7% (2.6%) more likely to work for part-time (full-time) jobs than non-drinkers. This positive correlation between drinking and employment may reflect the effect of income, or the social networking opportunities (e.g., drinking occasions) that come with work. Not surprisingly, history of chronic diseases is a barrier to employment, with presence of an additional increasing the probability of being without employment by 1.3% and decreasing the probability of full-time employment by 1%.

Family conditions also influence employment status among the elderly. Income compensation from children decreases the likelihood of the elderly to work. Results show that older people who have received financial support from their children are 7.5% more likely to be without employment and 1.7% (5.8%) less likely to work part-time (full-time), other things being equal. In addition, those who help with babysitting of grandchildren are 4.5% more likely to be without employment and 1.1% (3.4%) less likely to work part-time (full-time). In addition to family structure, social activities also play important roles on employment decisions. Elderly adults engaged in social services are 0.7% (2.3%) more likely to work part-time (full-time). A possible reason for these positive associations may be that elderly who engage in social service are more socially active in nature and are, consequently, more likely to work to keep interactions with their peers. Finally, the percentage of the employed elderly in the local area is important. This result continues to confirm the importance of the peer influence on employment from the previous studies (Araujo et al., 2010).

4.4. Other determinants of life satisfaction

Since similar variables are specified in both of the employment and life satisfaction equations, and two binary indicators of part-time and full-time employment are also included in the life satisfaction, the effects of the exogenous determinants on life satisfaction have to consider the direct effect (through the exogenous variables themselves) and the indirect effects (through the binary indicators of employment status). To investigate the extent to which the association between exogenous variables and life satisfaction may differ for different employment status, we calculate and report the *overall* marginal effects (both direct and indirect) conditional on no employment, part-time employment, and full-time employment in columns 4–6 of Table 4.

In general, the association between most exogenous variables and the conditional level of life satisfaction scores are in agreement qualitatively, in terms of signs and significance, across employment status, although the magnitudes do differ slightly. Notable differences are seen, for instance, in college degree, babysitting, family support, and exercise variables. Specifically, compared to those who have primary education, the marginal effects on life satisfaction scores for elderly with a college degree are 0.947, 0.850, and 0.868 for the without employment, part-time employed, and full-time employed. Receipt of financial support from children also significantly determines life satisfaction among the elderly without

employment (0.340). This result is expected because for elderly who are without employment, financial support from their children significantly contributes to their total disposable income for living. Finally, gender difference is also found for life satisfaction. Compared to their female cohorts, male elderly have a 0.355 lower life satisfaction score.

Lifestyle behaviors are also correlated with life satisfaction of the elderly. The association between exercise and life satisfaction are more significant among elderly without employment than those who work part-time or full-time. For those without employment, regular exercise increases life satisfaction by 1.202 points. In accordance with our findings in the employment equation, drinking behavior is positively correlated with life satisfaction. This result may reflect the fact that drinking is associated with more intensive social interactions, and therefore drinkers have higher life satisfaction. Drinking increases life satisfaction by 0.346 among part-time workers and 0.324 among full-time workers.

As expected, chronic health condition is negatively associated with subjective well-being of the elderly, and the results are robust across employment categories. For instance, old adults with chronic history conditions have lower life satisfaction scores by 0.227, 0.272, and 0.263 point for the elderly without employment, part-time and full-time employed elderly, respectively. Finally, social interactions contribute to life satisfaction. Participation in social service activities and volunteer work are positively associated with life satisfaction, and these associations are similar across employment statuses, ranging from 0.631 among those without employment to 0.733 among those with part-time employment.

5. Conclusions

Due to the increasing trend of retirement at an older age people have to work longer to support themselves. Also, there is a general belief that elderly are more vulnerable to mental illness. Therefore, there are growing concerns about the roles of employment on subjective well-being among the elderly populations worldwide. This study addresses this emerging public-policy concern by examining the role of socio-demographic variables, lifestyles, family support, and social interactions on employment and life satisfaction and the relationship between the two outcomes. In contrast to previous studies, we distinguish part-time and full-time employment. By developing and estimating an ordinal treatment effect model, we are able to control for the potential simultaneity due to unobserved characteristics on employment and life satisfaction.

Using a unique dataset from Taiwan, we find that socio-demographic variables, lifestyles, family structure, and social interactions play important roles on employment and life satisfaction among the elderly. The contribution of this study can be highlighted in several ways. First, in contrast to findings of previous studies on the general population, we find that part-time work is significantly and positively associated with life satisfaction of the elderly. These results are robust across socio-demographic groups, and the associations are more pronounced for males, those who have higher education, and those who are younger than 64 years old. In contrast, full-time employment negatively contributes to life satisfaction. This finding is not in accordance with most of the finding using a macro-level data.

Some policy implications may be drawn from our findings. Given the fact that in many economies people need to work longer in order to support themselves, and it is also well documented that elderly are more vulnerable to mental illness, it is important to know how employment may affect life satisfaction. Our findings point to a trade-off in term of policy prospect. Although working for a full-time job can generate income for living, it also has negative impacts on life satisfaction of the elderly. Therefore, how to balance the

increased wage income and the negative influence on mental health becomes an important policy issue. Given that many countries have considered to implement early retirement programs for the elderly, according to our findings, these programs can be more effective if part-time works are promoted among the elderly because we find that part-time work can be positively associated with mental health.

Although we have explored a unique dataset and obtained interesting findings, our results should be explained with some cautions. Our analysis is based on a cross-sectional dataset. Therefore, it may reflect the causal relation between employment status and life satisfaction. If data permit, the robustness of our findings can be further examined by using a panel dataset. Estimating a complicated econometric model with panel data is empirically challenging, and this issue is deferred to further investigations.

Appendix A. Life satisfaction index from 2003 SHLSE survey

Twelve questions are included in the survey which reflect the different aspects of life satisfaction. These questions are

- (1) I have had more breaks in life than most of the people I know (compared to elderly neighbors and relatives).
- (2) As I look back on my life, I am fairly well satisfied.
- (3) My life could be happier than it is now.
- (4) I would not change my past even if I could.
- (5) These are the best years of my life.
- (6) Most of the things I do are boring or monotonous.
- (7) I have always felt interested in the things I have done.
- (8) I expect some interesting and pleasant things to happen to me in the future.
- (9) I feel old and somewhat tired.
- (10) I've become pretty much what I expected out of life.
- (11) I feel like that I am living in the safety world.
- (12) I am satisfied with local environment (such as landscape).

Each respondent was asked if they “agreed” or “disagreed” to the statement in each question. In general, responses were coded as 1 for “agreed” and 0 for “disagreed”. Codings are reverse, viz., 0 for “agreed” and 1 for “disagreed”, for questions (3), (6), and (9). Binary responses are summed up over the 12 questions, to obtain an index one's overall assessment of life satisfaction. The life satisfaction score ranges from 0 to 12, with a large value indicating higher life satisfaction.

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