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Partial Retirement as A Separate Mode of Retirement Revisited

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MSc Thesis 05/2017-005

Partial Retirement as A Separate Mode of Retirement Revisited

by

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A thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Econometrics and Mathematical Economics

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May 25, 2017

Abstract

Older Americans tend to live longer and are healthier compared with prior cohorts. Recent research document that retirement trends of the elderly in the United States have changed dramatically from one-step traditional retirement pattern to a smoother one. We study how the personal, household, and financial characteristics impact on partial retirement patterns of older Americans between age 50 and 75. We find that respondents with high household income or respondents who have pension or annuity income tend to retire gradually with the use of part-time work. Moreover, respondents at good financial conditions are unwilling to stay longer in part-time work, but respondents with high household income are exceptions. To further analyze financial characteristics, we include four eligibility age indicators to investigate impacts of eligibility retirement ages for social security benefits. We find that when respondents are between normal retirement age and age 70, they are less likely to make transitions from part-time work to full retirement. In addition, when respondents are between normal retirement age and age 70, they would not stay longer in part-time work. In particular, we use multinomial probit model to examine determinants on retirement decisions, especially on part-time work. One advantage of using multinomial probit model is to avoid IIA (Independence of Irrelevant Alternatives) assumption.

Contents

1 Introduction

The traditional retirement pattern is a direct transition from full-time employment to full retirement. However, recent research document that retirement trends of older Americans have changed dramatically. Ruhm (1990) states that over half of people retire gradually at some point of their lives. Kantarci and Van Soest (2008) find that it becomes more common for older Americans to have a smooth transition to retirement with the use of part-time work. The new life-course trajectory documented by Brückner and Mayer (2005) is that life courses are different for people who born in different cohorts, and life courses are less predictable and more individualized in recent decades.

The switch from the traditional one-step retirement pattern to a smooth one is not surprising given the aging population in United States, since population aging will bring a problem of labor shortage. Americans cannot afford to keep the labor force structure unchanged. With the aging society, the labor force participation rate of older Americans is increasing. According to U.S. Bereau Statistics (2008), employment of older Americans at age 65 and above increased by 101% over the period of 1977 to 2007. This will raise a question for those older Americans whether they would choose part-time or full-time employment, because U.S. Bereau Statistics (2008) argues that there is a dramatic shift between part-time and full-time employment since the mid-1990. Part-time employment among older Americans has an upward trend between 1990 and 1995, but after 1995 the trend began to reverse with a sharp increase of full-time employment. The switch from the traditional retirement pattern to a smooth one is also due to increasing life expectancy for the elderly in United States. Ortman et al. (2014) state that older people in the United States are expected to reach 83.7 million in 2050, almost double its estimated population of 43.1 million in 2012. Based on Organization for Economic Cooperation and Development (2011), average life expectancy for Americans increased from age 77.4 in 1980 to age 80.3 in 2008. The first aim of this article is to analyze whether the elderly in United States choose a smoother retirement pattern with the use of part-time work.

Nardone (1986) states that among 3.3 million of old people who are above age 55, although 2.9 million of people choose to work part-time voluntarily, the number of them choose to work part-time for financial reasons is at 0.4 million in 1985. Working part-time could support some retirees who do not get enough pension or annuity income to pay for basic necessities, since part-time work can bring extra income. An annuity pays a certain amount of guaranteed income for a period of time, and people can buy annuity in a fund or life insurance company. Moreover, some part-time jobs even provide health insurance. Health insurance is important for older Americans who retire early and are not qualified for Medicare. Loprest and Zedlewski (1998) find that among old Americans between age 51 and age 61, about 12% of older Americans had no health insurance. Furthermore, Scott (2003) states that people would opt for partial retirement when they could receive a part of pension income to compensate with the reduced amount of wage. This means that retirement decisions of old workers are influenced by several aspects of financial conditions. The second aim of this article is to investigate impact of financial conditions on partial retirement patterns and partial retirement decisions.

Previous literature has widely discussed retirement transition rates from one working state to another. Gustman and Steinmeier (2000) find that people stay in the same working state between adjoining waves in about 77% of transitions. Kantarci and Van Soest

(2008) find that when considering transitions between two different working states, the most common transition is from full-time work to full retirement. It is of interest to explore retirement behaviors of older Americans in biennial waves among retirement transitions from and to part-time work. Furthermore, there is substantial number of people choosing to do a reversed transition from a low state of labor force participation to a high state. For example, some retired people would choose to return to the labor force as part-time workers. Kantarci and Van Soest (2008) also document that number of reversed transitions from part-time work to full time work is higher than monotonic transitions from part-time work to full retirement. The third aim of this article is to analyze the reasons why people make transitions from and to part-time work. This article provides a different perspective on consecutive changes of labor force statuses over two waves to understand reasons why older respondents make transitions from and to part-time work.

Previous research have explored on a rich set of factors that influence retirement patterns and retirement decisions of older Americans, e.g. Chen and Scott (2006), Cahill et al. (2006), Reitzes et al. (1998). Age, education, race and gender are extensively analyzed about effects on retirement patterns of older Americans. However, few research analyze whether eligibility retirement ages for social security benefits are significant predictors on retirement decisions of older Americans. Goss (2010) states that social security program cost would be higher than the annual tax income and this is mainly due to the aging population in United States. Under the demographic shift, Americans could not keep the normal retirement age unchanged. In order to cope with growing cost of social security system, normal retirement age of Americans is prolonged and adjusted by birth of year in United States. When Americans choose to retire as early as age 62 they will get a benefit reduction with maximum 30%. In addition, people are able to receive an increased benefit if they delay to claim social security benefits between normal retirement age and age 70, since increased benefits start to accumulate after normal retirement age and are no longer accumulated after age 70. We create four eligibility age indicators to examine whether retirement decisions on part-time employment are affected by eligibility retirement age for social security benefits. Eligibility age indicators include respondents who are under early retirement age, between early and normal retirement age, between normal retirement age and age 70, and above age 70. Therefore, we could investigate whether retirement patterns of older Americans are affected by financial incentives among those eligibility age indicators. In addition, Gustman and Steinmeier (2014) state that increasing normal retirement age affects retirement patterns of both husbands and wives, so we also include four eligibility age indicators for respondents' partners. Blau (1997) finds that social security benefits of partners have negative impacts on labor force participation of older married women, and have positive impacts on labor force participation of older married men.

In particular, we apply multinomial probit model to examine determinants on retirement decisions, especially on part-time work. In previous literature, e.g. Cahill et al. (2015), determinants of part-time work are investigated by multinomial logit model. However, using multinomial logit model needs the IIA (Independence of Irrelevant Alternatives) assumption. IIA means that the retirement decision of respondents between two working statuses is not affected by other working statuses. For example, when respondents choose between full-time work and full retirement, adding choice of part-time work will not affect respondents decisions between full-time work and full retirement.

Moreover, there is still a potential problem of unobserved heterogeneity, since explanatory variables might be affected by unobserved heterogeneity. For example, García-Pérez et al. (2013) find that if variable labor income is omitted effects of disposable income on retirement behaviors are largely underestimated, and if variable minimum pension income for unemployed people is omitted effects of disposal income on retirement behaviors are also underestimated. Therefore, we include multinomial logit model with and without fixed effects in Section 7 to control for unobserved heterogeneity. The statistical model, multinomial logit model with fixed effects, is based on Chamberlain (1979).

This article proceeds as follows. Section 2 summarizes the literature regarding to part-time work as a separate phase in retirement pattern for Americans. Section 3 describes the data. Section 4 reports several descriptive analyses on retirement patterns, including incidence of part-time work, transition probabilities between three working statuses in biennial waves, retirement sequences, and duration of part-time work. Section 5 explains methodologies for multinomial probit model, cox proportional hazard model, linear regression model, and multinomial logit model with and without fixed effects. Section 6 considers results of regression models regarding previous descriptive analyses. Section 7 presents robustness check. Section 8 concludes.

2 Literature Review

Some studies, e.g. Kantarci and Van Soest (2008), gradual retirement is considered as phased retirement (reducing work hours but not changing employer) and partial retirement (reducing work hours and changing employer) separately. In this article, partial retirement is defined as a reduction of work hours. Most studies agree on that advancing age, gender and race are important determinants on retirement outcomes and retirement patterns, e.g. Chen and Scott (2006), Cahill et al. (2006), Reitzes et al. (1998), Costa (1999). Costa (1999) finds that increasing age leads people to retirement. Gustman and Steinmeier (2000) find that men are more likely to be in nonretirement than women at old age. Quinn and Kozy (1996) find that women are more involved with bridge job than men, and bridge job is defined by Ruhm (1990) as reducing work hours and intermittent attachment with the labor force. Moreover, Gustman and Steinmeier (2000) find that whites are more likely to be in nonretirement than blacks or Hispanics. Flippen et al. (2000) also find the same retirement pattern that blacks, Hispanics and females experience more involuntary leave from the labor force, due to disadvantages in job opportunities. Baer (2015) find that among respondent who are above age 65 and older whites non-Hispanics are most likely to work part-time.

Labor income and education level are two important personal characteristics of the elderly. Scott (2003) finds that people who choose to phased retirement tend to be better educated and own more household income. People who are most educated and who earn high-salary have strong preferences to work as phased retirees, and the reason is that those people have abilities to choose a work which suits their preferences of work hours and level of responsibilities. Moreover, Ekerdt et al. (1996) state that there is a prevalence for higher- or lower-educated people to reduce work hours at old age than average educated people. Besides, another personal characteristic associates with health conditions. Pit et al. (2013) find that people who have depression, breast cancer, osteoarthritis are

more likely to be partially retire compared to people with no health problem. They also state that both men or women with other kinds of cancers (e.g. lung cancer) tend to fully retire, but women with breast cancer are more likely to partial retire. Moreover, Cahill et al. (2015) state that self-employment is an important way in post-career transitions of older Americans. Also, Quinn and Burkhauser (1990) state that self-employed people are more likely to reduce work hours and opt for partial retirement. Some older workers make a transition to self-employment when a wage-and-salary job does not meet their preferences.

There is some evidence that financial conditions of individuals stimulate the participation of older Americans in part-time work. Committee for Economic Development (1999) finds that financial incentives strongly influence decisions of older Americans on retirement patterns or retirement outcomes. Annuity income or health insurance in retirement life play an important role in retirement patterns or retirement outcomes of Americans. Latulippe and Turner (2000) argue that wage-and-salary workers will compare income differences between partial retirement and full retirement, and wage-and-salary workers are sensitive to financial conditions in partial retirement. Income differences here do not only mean the amount of wage differences but also the absolute level of pension benefits. For example, if pension benefits in full retirement are better than the sum of benefits in partial retirement and income in part-time work, workers will be less inclined to partial retirement. Moreover, Scott (2003) state that when older workers could receive a part of pension income as extra income for the reduced amount of wage, these workers could choose to reduce work hours and retire partially. In addition, Stock and Wise (1988) examine effects of defined benefit and defined contribution retirement plans on firm departure rates of older Americans, and they contend that being covered in defined benefit plans provides strong incentives for people to stay in the firm. This suggests that being covered in defined benefit plans triggers people to make different retirement decisions. Moreover, Haider and Loughran (2001) find that wealthiest people are willing to continue to work at older age. Haider and Loughran (2001) also state that older workers are insensitive to wage, and the elderly earn relatively low wage. However, Haider and Loughran (2001) only state that wealthy people are willing to stay in the labor force, but not specify whether wealthy people would stay in part-time or full-time employment. ICK (1992) argue that among people who invest in real estate and bank deposits, they would opt for a partial withdrawal from the labor force, since those people have sufficient household wealth to pay for basic necessities after leaving the labor force.

Retirement decisions also link to household characteristics, such as family size and marital status of older Americans. Reitzes et al. (1998) find that family size has strong effects on encouraging women to stay or reenter the labor force because financial constraints increase with the number of children, and these pressures keep them to stay employed. Considering for marital status, Blau and Riphahn (1999) find that part-time employment is not prevalent among old couples unless both husbands and wives can stay employed.

3 Data description

The dataset used to analyze retirement patterns is from the Health and Retirement Study (HRS). The HRS is a household survey conducted among elderly Americans every two years. The survey first started in 1992, and includes information about health, work, pension, financial status, and family structure among both respondents and their spouses or partners. We choose five biennial waves covering the period from 2006 to 2014 (wave 8 to 12). The sample is restricted to respondents between age 50 and 75, since this article only studies the retirement behaviour of older Americans. Moreover, in regression analysis we do not consider respondents who are unemployed, disabled, or not in the labor force, since for those people retirement is difficult to differentiate from their current labor market statuses. The dataset consists of 11917 respondents where 5174 of them are men and 6763 of them are women. In wave 8, 2823 of respondents were working full-time, 1066 of them were working part-time, and 1652 of them retired.

3.1 Measuring Work Intensity

In the HRS, there are seven categories of labor market statuses: work full-time, work part-time, unemployed, partly retired, retired, disabled, and not in the labor force. The HRS distinguishes between two modes of part-time work by whether the respondent mentions about retirement. For instance, if respondents report themselves as retired but still work less than 35 hours per week, the HRS categorizes those respondents as partly retired, while if respondents work less than 35 hours per week and do not mention about retirement, then those respondents are treated as working part-time. In this article, we combine two-modes of part-time employment into one status as part-time work, since we are not analyzing whether people report themselves as retirement and still working but analyzing retirement patterns of people who work less than 35 hours per week. Therefore, the status "part-time work" represents working less than 35 hours per week and not considering whether respondents mention about retirement. The status "others" represents the group of respondents who are unemployed, disabled, or not in the labor force during a given survey year. In this article, working statuses are summarized into four categories: full-time work, part-time work, full retirement, and others.

Usually, there are two ways to define retirement statuses. One definition is based on self-reported working statuses, and the other is based on the number of work hours. In HRS, self-reported working status is summarized by different questions and information from several sources. For example, HRS sets respondents as unemployed when the respondent is not working and is looking for a job, and HRS sets respondents as retired when the respondents is not working and there is any mention of retirement, meaning that the classification of working statuses is based on multiple measures. For the second definition, the HRS defines part-time work as working at most 34 hours per week and at most 36 weeks per year, while the U.S. Bureau Labor Statistics defines part-time work as working at most 34 hours per week, but U.S. Bureau Labor Statistics does not set an annual basis. Some studies, e.g. Haider and Loughran (2001), use an annual basis as working less than 1750 hours for 50 weeks per year. In this article, we choose the first definition, since it classifies working statuses of respondents by using multiple measures.

3.2 Retirement Eligibility Ages

We create four eligibility age indicators to measure whether specific eligibility ages for social security benefits affect retirement decisions of respondents. Those specific eligibility ages of retirement are early retirement age, normal retirement age and age 70. The reason why we use early retirement age as a threshold is that respondents under age 62 are not legally eligible for social security benefits in United States. In addition, if people choose to retire as early as age 62, social security benefits would be reduced up to a maximum of 30% depending on respondents' year of birth (Table 1). Moreover, at normal retirement age, respondents can get benefits which are neither reduced for early retirement nor increased for delayed retirement. For respondents born before 1937 and prior, normal retirement age is fixed at age 65, but for respondents born after 1938, government adjusted the normal retirement age according to respondents' year of birth (Table 1). One reason of using age 70 as an eligibility age indicator is that Americans could delay to retire for increased benefits (in an approximately actuarially fair way) until age 70 (Table 2). Another reason is that before year 2000, if respondents who are between normal retirement age and age 69 continue to work full-time, they will get a reduction on social security benefits because of the earnings test. The earnings test applies for Americans who are between early and normal retirement age and it calculates the amount of reduced social benefits of Americans if they work after age 65. With these eligibility ages, respondents are divided into four groups, including respondents under early retirement age, between early and normal retirement age, between normal retirement age and age 70, and above age 70.

Moreover, we include the same four eligibility age indicators for respondents' partners, and here partners not only represent their married spouses but also people who cohabit together. One reason of including eligibility age indicators for respondents' partners in the dataset given by Gustman and Steinmeier (2014) is that increasing normal retirement age affects retirement patterns of both husbands and wives. Moreover, they also find that the increasing labor force participation of wives caused a reduction of labor supply of their husbands.

[1]The1983 Social Security Amendments included a provision for raising the full retirement age beginning with people born in 1938 or later. The Congress cited improvements in the health of older people and increases in average life expectancy as primary reasons for increasing the normal retirement age.

Table 1: Retirement Eligibility Age & Reduced Benefits At Age 62

		Retire At Age 62	
Year of Birth	Normal Retirement Age	$1000 reduce to	Reduced benefit%
1937 or earlier	65	$800	20.00%
1938	65 and 2 months	$791	20.83%
1939	65 and 4 months	$783	21.67%
1940	65 and 6 months	$775	22.50%
1941	65 and 8 months	$766	23.33%
1942	65 and 10 months	$758	24.17%
1943-1954	66	$750	25.00%
1955	66 and 2 months	$741	25.83%
1956	66 and 4 months	$733	26.67%
1957	66 and 6 months	$725	27.50%
1958	66 and 8 months	$716	28.33%
1959	66 and 10 months	$708	29.17%
1960 and later	67	$700	30.00%

Notes: 1. If you were born on January 1st, you should refer to the previous year. 2. You must be at least 62 for the entire month to receive benefits. 3. Percentages are approximate due to rounding.

Table 2: Delayed Retirement Benefits

Year of birth	Late Retirement Age	Credit per year
1917-24	70	3.0%
1925-26	70	3.5%
1927-28	70	4.0%
1929-30	70	4.5%
1931-32	70	5.0%
1933-34	70	5.5%
1935-36	70	6.0%
1937-38	70	6.5%
1939-40	70	7.0%
1941-42	70	7.5%
1943 and later	70	8.0%

Notes: 1. If you were born on January 1st, you should refer to the previous year. 2. Percentages are approximate due to rounding.

3.3 Health Index

In the HRS, respondents are asked about their self-reported health statuses, where the answer categories are excellent, very good, good, fair, and poor health. Health is difficult to measure because of justification bias. Justification bias means that respondents who are willing to retire early might exaggerate their poor health status. For example, Bound and Waidmann (2007) state that having cold is a minor problem to some respondents who are willing to continue to work in the labor force, but to others who would like early retirement they would treat it as a more serious problem. Therefore, we adopt a method to create a health index according to Coe and Zamarro (2011). The index can be constructed by predicting self-reported health with a set of objective health measures. We use a fixed effect regression to control for unobserved heterogeneity. That is, we predict self-reported health as follows:

$$Y_{it} = \alpha + H_{it}\beta + \mu_i + \epsilon_{it}$$

Y_{it} is the self-reported health, numbered from 1 (Excellent) to 5 (poor). H_{it} is a vector of objective health measures. μ_i is the time invariant individual specific error term, and μ_i can be potentially correlated with control variables. ϵ_{it} is the error term and is assumed to be independent and identically distributed over time and individuals, with a zero mean and variance σ^2_ϵ. α is a vector of unobserved variables. The objective health measures contain several primary functional limitation indices as indicators for previous or current health conditions, including number of activities and number of instrumental activities of daily living where the respondent reports any difficulty[2], the sum of health issues[3], mobility index[4], and large muscle index[5], hospital overnight stay during the last 2 years, body mass index, overweight and obesity dummies, and mental health. The estimation results are presented in Table 3. Except for the dummy variable 'overweight', other dummy variables are all statistically significant with plausible signs.

Nevertheless, there is still a potential of endogenous problem between retirement outcomes and health status. Poor health statuses may affect retirement decisions with labor force statuses. In the meantime, being in some physical work could be harmful to their health conditions. In order to tackle this kind of simultaneity bias, we use the lagged health index, since working statuses cannot influence lagged health conditions.

[2]Number of activities of daily living includes problems with bathing, dressing, eating, getting in/out of bed and walking across a room. Number of instrumental activities of daily living includes problems with using the phone, managing money, taking medications, shopping for groceries, and preparing hot meals. Both variables take values from 0 (no problems) to 5 (many problems).

[3]The sum of health conditions is a count of health issues the respondent had according to a doctor. The health issues include high blood pressure, diabetes, cancer, lung disease, heart problems, stroke, psychiatric problems, and arthritis. The variable takes values from 0 (none of the conditions) to 4 (all conditions).

[4]The mobility index includes walking one block, walking several blocks, walking across a room, climbing one flight of stairs, and climbing several flights of stairs to indicate health problems. The variable takes value from 0 (no difficulty) to 5 (many difficulty).

[5]The large muscle index includes sitting for two hours, getting up from a chair, stooping or kneeling or crouching, and pushing or pulling a large object. Both variables take value from 0 (no difficulty) to 5 (many difficulty). The variable takes value from 0 (no difficulty) to 4 (many difficulty).

Table 3: Fixed Effects Results for Health Index

	Self-reported Health	
	Coef	Std. Err.
Number of ADL limitations	0.043***	0.012
Number of IADL limitations	0.023*	0.013
Number of Motor Activities	0.106***	0.006
Number of Muscle Use Difficulties	0.060***	0.006
Sum of Health Conditions	0.137***	0.008
Hospital Stay	0.003***	0.001
Overweight	0.028	0.019
Obese	0.098***	0.025
Mental Health	0.044***	0.003
Constant	2.148***	0.024
F-test	0.000	
Number of Obs.	28,472	

Notes: 1. Linear regression model with fixed effects. 2. *** p<0.01, ** p<0.05, * p<0.10. 3. F-test is presented with p value.

4 Descriptive Statistics

This section provides summary statistics on four aspects of part-time work: incidence, transition probabilities from and to part-time work, retirement patterns over time including part-time work, and duration of part-time work.

4.1 Incidence of Partial Retirement

In this section, we analyze the fraction of respondents in four working statuses: full-time work, part-time work, full retirement, and others. Table 4 presents fractions of four working statuses in different groups. As discussed in Section 3.2, respondents are separated into four groups, such that group **A** includes those who are under early retirement age, group **B** includes those between early retirement age and normal retirement age, group **C** includes those between normal retirement age and age 70, and group **D** includes those above age 70. We present percentages of part-time work in wave 8, 10 and 12 to observe retirement trends over waves.

Considering each wave, a large number of full-time workers start to retire at early retirement age, and numbers continue to increase after normal retirement age. One possible reason is that people start to claim social security benefits when reach early retirement age. Another possible reason given by Costa (1999) is that retirement probabilities increase with advancing age, since when people are above age 65 their productivity and wages are lower. Although respondents who retire between early retirement age and normal retirement age would suffer a maximum 30% reduction in benefits, 41.85% of respondents in wave 8 opt for full retirement when at that group. Moreover, among respondents who work full-time, percentages of them decrease across waves when they are under early retirement age. The reason for this percentage change is simply because sample is aging with waves. In addition, although most respondents opt for full retirement or a reduction of work hours, 7.28% of respondents are still in full-time work even after age 70 in wave 12.

Across groups, percentage of respondents being in part-time work substantially increase from 14.71%, 20.46%, to 20.69% in wave 8, and this means that respondents have a higher tendency to work part-time with advancing age. However, we cannot observe percentages of respondents who above age 70 in any working statuses in wave 8, since we restrict the sample to respondents between age 50 and 75 for each wave. Hence, there are no respondents above age 70 in wave 8. In wave 10, proportion of respondents being in part-time work first increases with groups, and then declines when respondents are above age 70. Wave 12 also shows the same trend, but with relatively stable percentages across four groups. In addition, percentages of part-time work in wave 10 and 12 are smaller than in wave 8 for respondents between early and normal retirement age, indicating that respondents between early and normal retirement age have a downward trend in working part-time over last 10 years. The same trend of part-time work also suits for respondents between normal retirement age and age 70. Thus, we can conclude that there is a prevalence of working part-time for respondents under age 70 in each wave. A possible explanation is that Americans could delay to retire for increased benefits until age 70, and they could receive extra income from part-time work to compensate for expenses.

Table 4: Percentage reporting four working status

	Wave 8				Wave 10				Wave 12			
	A	B	C	D	A	B	C	D	A	B	C	D
F	55.92	27.99	18.40	0.00	51.19	27.85	14.91	7.97	49.90	28.76	15.02	7.28
P	14.71	20.46	20.69	0.00	14.98	16.82	18.76	17.52	15.21	15.37	15.90	15.23
R	15.21	41.85	51.40	0.00	15.54	45.02	59.53	69.98	21.55	48.69	63.88	73.85
O	14.17	9.70	9.52	0.00	18.29	10.32	6.80	4.53	13.34	7.18	5.20	3.64

Notes: 1. Groups A, B, C, and D stand for four groups. Group A: respondents under early retirement age; Group B: respondents between early retirement age and normal retirement age; Group C: respondents between normal retirement age and age 70; Group D: respondents above age 70. 2. F = Full-time work; P = Part-time work; R = Full Retirement; O = Others.

4.2 Transition Probabilities

Table 5 shows transition probabilities during the period of 2006-2014 for consecutive waves (2006-2008, 2008-2010, 2010-2012, and 2012-2014). Transition probabilities are calculated by the number of people making a transition from one state to another, and then divide this by the total number of respondents in the initial state. In this section, the dataset is separated into two groups by early retirement age since in incidence analysis we find that retirement outcomes of respondents who are under early retirement age are substantially different from retirement outcomes of respondents who are above. Moreover, we present transition probabilities of all respondents to examine whether respondents who are under or above early retirement age show a different retirement pattern with all respondents. The transition types are presented in abbreviations. For example, FR represents transition from full-time work to complete retirement.

Considering all respondents, 12.14% of those respondents choose to make a transition from full-time work to part-time work. When their initial state is full-time work, transition probability of respondents who make transitions to part-time work (FP) is slightly higher than respondents who retire directly (FR) as 12.14% and 11.89%. This finding is contradicted with Kantarci and Van Soest (2008). Kantarci and Van Soest (2008) find that when considering transitions between two different working states, the most common transition is from full-time work to full retirement. One possible reason for this contradiction is that Kantarci and Van Soest (2008) distinguish part-time employment into two modes. Among respondents whose initial state is part-time work, fraction of those moving into full retirement is similar with that of those moving into full-time work. If the initial state of respondents is part-time work, half of them would stay in the same state. Gustman and Steinmeier (2000) find that people stay in the same working state between adjoining waves in about 71% of transitions. When we compare consecutive stay in full-time work (FF), part-time work (PP), and full retirement (RR), the consecutive stay in part-time work has the lowest percentage at 52.35% and percentages of consecutive stay in full-time work and full retirement are over 70%. Moreover, there is also a backward trend of transitions from full retirement to part-time and full-time work for 8.12% and 11.77% of the full sample.

Compared with two separated groups, transition probabilities are similar as group

Table 5: Transition Probabilities

	All age	Age<62	Age⩾62		All age	Age <62	Age⩾62
FF	70.25	73.39	67.88	PF	19.95	25.74	18.22
FP	12.14	10.86	12.74	PP	52.35	50.64	52.47
FR	11.89	9.82	14.12	PR	21.65	16.25	23.93
FO	5.72	5.92	5.26	PO	6.05	7.37	5.38
	All age	Age <62	Age ⩾62		All age	Age <62	Age ⩾62
RF	11.77	18.16	10.69	OF	12.23	14.09	11.47
RP	8.12	7.93	8.03	OP	8.78	9.43	7.84
RR	73.41	64.41	75.21	OR	39.71	35.93	42.93
RO	6.70	9.51	6.08	OO	39.28	40.55	37.76

Notes: 1. Number of observations are presented as percentage. 2. F = Full-time work; P = Part-time work; R = Full retirement; O = Others

of all respondents for transitions from full-time work to other statuses and transitions from full retirement to other statuses. Among respondents under age 62, fractions of those who move from part-time to full-time work is higher than that of those who move from part-time work to full retirement, while among respondents above age 62, fractions of those who move from part-time to full retirement is higher than that of those who move from part-time to full-time work. When we consider consecutive stay in part-time work with two separated groups, percentages are similar with total group. In two separated groups, we also find that a large percentage of respondents experiences a backward transition which means they work more hours than their initial state, especially among respondents under age 62. For respondents who are already retired and under age 62, 18.16% of them choose to reenter the labor market as full-time workers. 18.22% of respondents have reversed transitions from part-time to full-time work when respondents are above age 62.

4.3 Retirement Sequence

This section presents the retirement patterns of the elderly in United States. Sequences stand for particular retirement patterns over a period of life cycle, and the period here is considered as 5 waves. The sequence contains four letters, and each letter represents a particular labor force status: full-time work (F), part-time work (P), full retirement (R), and others (O). For instance, the sequence FPPRR represents respondents who work full-time in first wave, work part-time in second and third waves, and completely retire in fourth and fifth waves. There are five waves and four possible working statuses in each wave, and hence there are in total 1024 possible sequences. Table 6 shows fractions for 53 sequences which have at least 0.25% frequency in the sample data. These sequences represent 79.7% of retirement patterns among all respondents. Part-time work occurs at least once in 22.11% of all sequences.

Table 6 suggests that in 53 selected sequences, 11.12% of respondents has a direct transition from full-time work to complete retirement without using part-time work. By

reducing certain amount of work hours, respondents could use part-time work as a mode to prepare them for full retirement or as a replacement of full-time work. 12.88% of sequences represent a monotonic decrease in work hours with the use of part-time work, indicating that about one out of ten respondents opt for a part-time job before entering full retirement. The percentage of respondents retiring gradually is much lower than Ruhm (1990) who states that over half of people retire gradually. A possible reason for the difference is that we only consider respondents whose retirement patterns present a monotonic decrease in work hours with the use of part-time work. We also find that substantial number of respondents engage in reversed retirement which accounts for 5.09% of all cases. Here the reversed retirement pattern includes all possible backward transitions, meaning that we include, e.g. sequence PFRRR, although in this sequence respondents only increase work hours in one wave. Our findings are consistent with Gustman and Steinmeier (2000) who consider sequences over 4 waves between 1992-1998. They find that direct transitions from full-time work to retirement is 12.75% without using part-time work, and part-time work occurs at least once in 14.80% of all sequences. In addition, 14% of respondents experience a reversed transition pattern.

Three most representative sequences are consecutive stays across five waves in complete retirement, full-time work, and part-time work, and in total these sequences represent 36.68%. Percentages of these sequences are consistent with transition probabilities for consecutive stay in one state, since among all respondents consecutive stay in one working status over two waves accounts for the highest percentages for each working status. This suggests that when people decide to enter into one working status, they are less likely to make transitions to another. In Gustman and Steinmeier (2000), 35.43% of sequences are continuous stays in full-time work, but the second most representative sequence is a direct transition from full-time work to retirement (FFFR), representing 5.44% of sequences.

Table 6: Retirement Sequence

Rank	Sequence	Fraction	Rank	Sequence	Fraction	Rank	Sequence	Fraction
1	RRRRR	18.91	19	PPPPR	1.04	37	FFFPR	0.35
2	FFFFF	14.30	20	OOORR	0.94	38	PFFFF	0.34
3	PPPPP	3.47	21	FFORR	0.90	39	PFRRR	0.34
4	FFRRR	3.25	22	FFFPF	0.62	40	RRRRP	0.34
5	FFFFR	2.83	23	FFFFO	0.57	41	ORORR	0.34
6	ORRRR	2.68	24	FFPFF	0.55	42	FFFRP	0.30
7	FFFRR	2.61	25	OOOOR	0.54	43	FFOOR	0.30
8	FRRRR	2.43	26	FPFFF	0.50	44	OOROO	0.30
9	PRRRR	1.99	27	FORRR	0.50	45	FFFOR	0.28
10	FFFFP	1.66	28	RPRRR	0.50	46	RPPPP	0.28
11	PPRRR	1.64	29	FFPPR	0.49	47	RPPRR	0.28
12	RORRR	1.54	30	FFPRR	0.49	48	RRPPP	0.28
13	OOOOO	1.51	31	FPRRR	0.47	49	RRROR	0.28
14	OORRR	1.46	32	PORRR	0.42	50	FFOPP	0.25
15	PPPRR	1.14	33	FPPRR	0.39	51	RRRRO	0.25
16	FFFPP	1.11	34	PFPPP	0.39	52	ROORR	0.25
17	FFPPP	1.07	35	RRRPR	0.37	53	OFFFF	0.25
18	FPPPP	1.04	36	RRORR	0.37			

Notes: 1. Retirement sequences presented are ranked by fraction. 2. F = Full-time work; P = Part-time work; R = Completely Retired; O = Others

4.4 Duration

Figure 1 presents the Kaplan-Meier estimates of survival probabilities of part-time work. In this section, we also separate the dataset into two groups by early retirement age (62). The blue line of Age62 = 0 represents respondents under age 62, and the red line of Age62 = 1 represents respondents at age 62 and above.

Among respondents above age 62, almost 58% of them stay in part-time work for at least 2 waves meaning that respondents stay in four consecutive calendar years, while among respondents under age 62, about 62% of them stay in part-time work for at least 2 waves. This indicates that more than half of respondents who choose to start working part-time will stay in part-time work for at least 2 waves. After staying in part-time work for 2 waves, survival probabilities for two groups show no significant differences. At the end of the observation period, about 25% of respondents whose initial state is part-time work at any given wave still stay in part-time work for both groups.

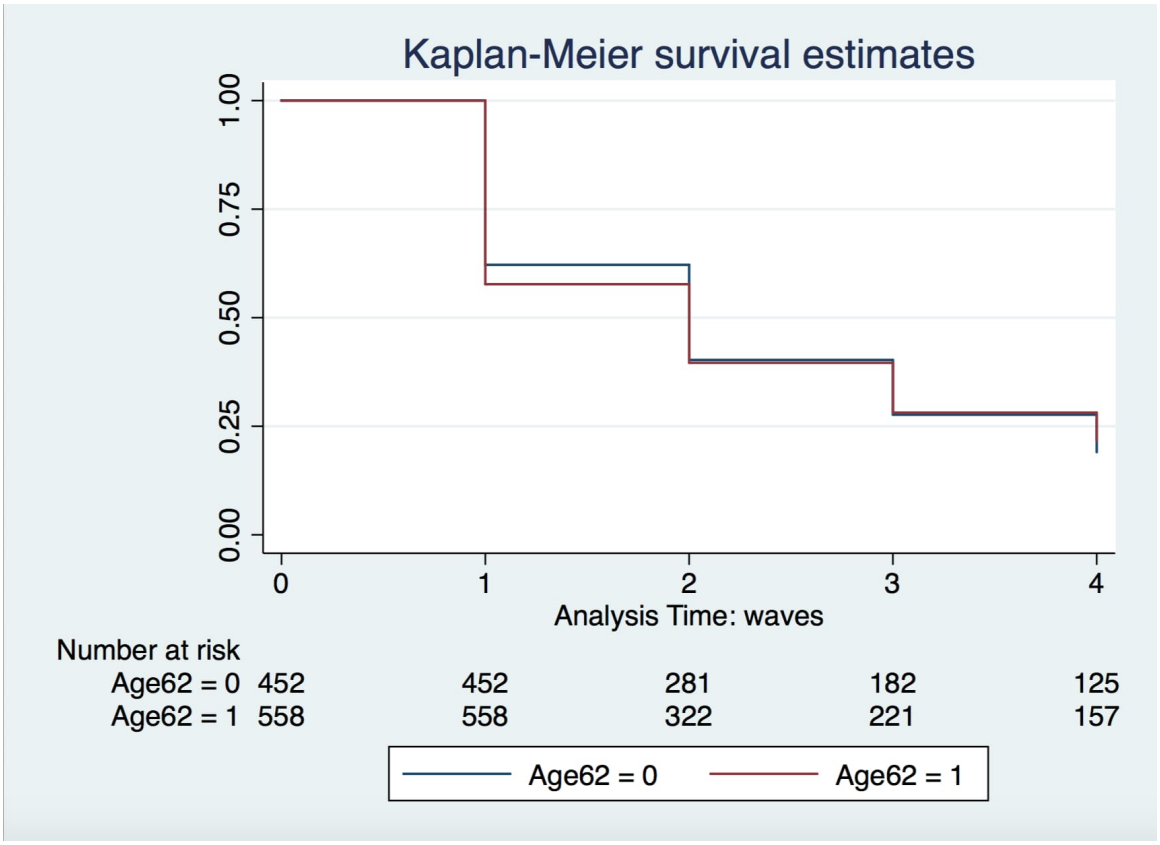

Figure 1: Kaplan-Meier estimate of Survival Probabilities

5 Methodology

5.1 Multinomial Probit Model

In order to examine effects of determinants on full-time and part-time work, we use a multinomial probit model. Multinomial probit model is used to examine relationship between a polytomous outcome variable and a set of regressors. One advantage of multinomial probit model is that multinomial probit model can avoid IIA (Independence of Irrelevant Alternatives) constraint by allowing a general structure of the error term, while the multinomial logit model has the assumption of independence of irrelevant alternatives (IIA). IIA means that respondents' retirement decision between two working statuses is not affected by other working statuses. In other words, if respondents choose between full-time and part-time employment, adding choice of full retirement has no effects on their decisions between full-time and part-time employment. In our multivariate analysis, the outcomes consist of three working statuses, including full-time work, part-time work, and full retirement. The regression function is as following:

$$Y_{ij}^* = x_{ij}'\beta + \epsilon_{ij}$$

Where, Y_{ij}^* is the latent prospensity of j working statuses for individual i. The outcome $j = 1, ..., J$ represents full-time work, part-time work, or full retirement. x_{ij} is a vector of independent variables, β is a vector of estimated coefficients. ϵ_{ij} is the error term. The error term is assumed to be jointly normally distributed, with a zero mean and covariance matrix $\Sigma = \begin{pmatrix} \sigma_1^2 & \sigma_{12} & ... & \sigma_{1n}^2 \\ \sigma_{12} & \sigma_2^2 & ... & ... \\ ... & ... & ... & ... \\ \sigma_{1n} & ... & ... & \sigma_n^2 \end{pmatrix}$. In multinomial probit model, Σ is not restricted to be a diagonal matrix and can be specified differently from different multinomial probit model. For a multinomial probit model with three outcomes, the probabilities of choosing outcome 1 is:

$$Pr(Y_i^* = 1) = \int_{-\infty}^{-\tilde{V}_{i21}} \int_{-\infty}^{-\tilde{V}_{i31}} f(\tilde{\epsilon}_{i21}, \tilde{\epsilon}_{i31}) d\tilde{\epsilon}_{i21} d\tilde{\epsilon}_{i31}$$

Where, $\tilde{\epsilon}_{i21} = \epsilon_{i2} - \epsilon_{i1}$, and $f(\tilde{\epsilon_{i21}}, \tilde{\epsilon}_{i31})$ is the joint probability density function of the multivariate normal distribution with respect to $\tilde{\epsilon_{i21}}$ and $\tilde{\epsilon}_{i31}$. $\tilde{V}_{i21} = V_{i2} - V_{i1}$, and V_{ij} depends on independent variables and estimated coefficients β.

5.2 Hazard Model

The cox proportional hazard model is used to analyze transitions from a given working status to another, such as transitions related to part-time work. The advantage for a cox proportional hazard model is that the shape of baseline hazard is not restricted and not affected when adding covariates. In parametric model the shape of the baseline hazard function is restricted. If the baseline hazard is mis-specified in the parametric model, the estimated results can be biased. Applying a cox proportional hazard model

can address this concern by combining a nonparametric specification of baseline hazard with proportional hazard assumption that individual characteristics changes hazard rate proportionally.

Here, the hazard model examines how determinants affect spell lengths. A spell is the duration or time length that respondents stay in a state before transitioning to another state (failure). We assume the duration or time length for a respondent is a random variable T, then the cumulative distribution function is $F(t) = pr(T \leq t)$, while a survivor function $S(t)$ is defined as $S(t) = Pr(T \geq t)$. In other words, the survivor function $S(t)$ is related to $F(t)$ as $F(t) = 1 - S(t) = Pr(T \leq t)$. Therefore, the hazard rate (the failure rate) is defined as conditional probability for an instantaneous failure (change of working states) in time interval $(t, t + h)$ for each individual with no failure (stay in initial state) until $T = t$:

$$\lambda(t) = \lim_{h \to 0} \frac{Pr(t \leq T \leq t + h | T \geq t)}{h}$$

In cox model, the hazard model is given as follow,

$$\lambda(t|x, \beta) = \lambda_0(t) exp(x'\beta)$$

where β is the estimated coefficients, x is a vector of determinants, $\lambda_0(t)$ is the baseline hazard function. Cox (1972, 1975) proposed a method that not require estimate β and baseline hazard simultaneously. The baseline hazard function $\lambda_0(t)$ is dropped out when estimating conditional probability of failure. Considering a spell which is at-risk of ending at time t_j, the conditional probability of failing at time t for spell j is that:

$$\begin{aligned} Pr(T_j = t_j | R(t_j)) &= \frac{Pr(T_j = t_j | T_j \geq t_j)}{\sum_{l \in R(t_j)} Pr(T_l = t_l | T_l \geq t_j)} \\ &= \frac{\lambda_j(t_j|x_j, \beta)}{\sum_{l \in R(t_j)} \lambda_l(t_j|x_l, \beta)} \\ &= \frac{exp(x'\beta)}{\sum_{l \in R(t_j)} exp(x'\beta)} \end{aligned} \tag{5.1}$$

Equation (5.1) proves that cox model does not need the baseline hazard function, since it dropped out during estimation.

5.3 Simple Linear Model

As discussed in Section 4.3, almost 60% of respondents are willing to stay in part-time work for 2 years, while 25% of respondents are willing to stay for 8 years. It is of interest to investigate which observables drive respondents to stay longer in part-time work. Thus, we could examine this relationship by using the simple linear model estimated by OLS estimation with:

$$y_i = x_i \beta + \epsilon_i$$

y_i is the duration of time in part-time work for each respondent, and here durations are restricted to one, two, three, and four waves (2, 4, 6, and 8 years). Since we only observe

working statues at the endpoint of 5 waves, the longest duration in part-time work would be 8 years. x_i is a vector of determinants, which are the same as in the multinomial probit model. β is a vector of coefficients to indicate whether determinants affect the length of time that respondents stay in part-time work.

5.4 Multinomial Logit Model with and without Fixed Effects

In order to examine effects of determinants on full-time and part-time work, we use a multinomial logit model with and without fixed effects. Multinomial logit model is used to examine relationship between a polytomous outcome variable and a set of regressors. In our multivariate analysis, the outcomes consist of three working statuses, including full-time work, part-time work, and full retirement. The regression function is as following:

$$Y^*_{itj} = x'_{it}\beta_j + \epsilon_{itj}$$

Where, Y^*_{itj} is the latent prospensity of j working statuses for each individual i at time t. The outcome $j = 1, ..., J$ represents full-time work, part-time work, or full retirement. x_{it} is a vector of independent variables, β is a vector of estimated coefficients. Here, we define the outcome full retirement as the base outcome, while B represents the base outcome. In multinomial logit model, we restrict base outcome as 0, so $\beta_B = 0$. ϵ_{itj} is the error term. The error term is assumed to be independent and identically distributed over time and individuals, with a zero mean and variance σ^2_ϵ. The probabilities of each outcome are:

$$Pr(Y^*_{it} = J|\beta, x_{it}) = \begin{cases} \frac{exp(x'_{it}\beta_j)}{1+\sum_{k\neq B} exp(x'_{it}\beta_k)} & j \neq B \\ \frac{1}{1+\sum_{k\neq B} exp(x'_{it}\beta_k)} & j = B \end{cases}$$

However, a potential problem is that the estimates might be inconsistent because unobserved heterogeneity can be related with observed covariates. García-Pérez et al. (2013) find that if variable minimum pension income for unemployed people is omitted retirement effects of disposal income on retirement behaviors are underestimated. Thus, we use the multinomial logit model with fixed effect to control for omitted variable bias. The function of multinomial logit model with fixed effect is given by:

$$Y^*_{itj} = \alpha_{ij} + x'_{it}\beta_j + \epsilon_{itj}$$

α_{ij} is an unobservable individual specific variable. Pforr et al. (2014) states that the consistent estimation of multinomial logit model with fixed effects needs two assumptions. One assumption is that observed covariates are strictly exogenous $f_{Y_{it}|x_{i1},...,x_{1T},\alpha_i} = f_{Y_{it}|x_{it},\alpha_i}$. The other assumption is that error terms are independent across time: $\vee s, t : \epsilon_{isj} \perp \epsilon_{itj}$. Under these assumptions, the likelihood function can be reformulated with the implied estimator of β. Based on Chamberlain (1979), we assume $\delta_{itj} = 1$ if $Y_{it} = j$ and $\delta_{itj} = 0$ otherwise, where δ represents the Kronecker delta function with respect to Y_{it} and j. The term $\theta_{ij} = \sum_{t=1}^{T_i} \delta_{itj}$ is the sufficient statistic[6] for unobserved heterogeneity α_{ij}. This term means that the sum of occurrences of an outcome j for each individual i across time is a sufficient statistic for choosing to that outcome. The mass probability function

for chosen outcomes across time for individual i conditional on sufficient statistics is

$$f_{Y_i|\alpha_i,\beta,x_i,\theta_i} = \frac{exp(\sum_{t=1}^{T_i}\sum_{j=1,j\neq B}^{J}\delta_{itj}x_{it}\beta_j)}{\sum_{\tilde{m}\in M_i} exp(\sum_{t=1}^{T_i}\sum_{j=1,j\neq B}^{J} m_{itj}x_{it}\beta_j)}$$

where, $M_i = \{\tilde{m} = (m_{i1}, ..., m_{iT_i})|m_{itj} = 0 \text{ or } 1, j = 1, ..., J : \sum_j m_{itj} = 1, \sum_t m_{itj} = \delta_{ij}\}$, and $\tilde{m}$ are all potential sequences of chosen outcomes.

In logit model, estimates of independent variables are interpreted in terms of odds-ratio or marginal effects, and usually odds-ratio is considered as unintuitive. However, in fixed effect model, we cannot use marginal effects to interpret estimates of covariates. The predicted probabilities cannot be evaluated, since the unobserved heterogeneity vector α_{ij} is not estimated. Although there is a way to find a plausible α_{ij}, the interpretation is less intuitive than in the case of odds-ratio. In this case, we choose to use odds-ratio to interpret both models. The odds ratio is the effect of change of statues in explanatory variables. In simple logit model, if we increase one unit in explanatory variable, the odds would be

$$\frac{P(y_i = 1|x_i)}{P(y_i = 0|x_i)} = \frac{exp(x_i\beta + \beta_i)}{exp(x_i\beta)} = exp(\beta_i)$$

The term $exp(\beta_i)$ is the odds ratio. While, in multinomial logit model the odds ratio for outcome j is calculated as

$$\frac{e^{\beta_1^{(j)}x_1+...+\beta_i^{(j)}(x_i+1)+...+\beta_k^{(j)}x_k}}{e^{\beta_1^{(j)}x_1+...+\beta_i^{(j)}(x_i)+...+\beta_k^{(j)}x_k}} = e^{\beta_i^{(j)}}$$

[6]Sufficient statistic summarize all the information in a sample that needed to compute any estimates about the desired variable. Here, we apply the sufficient statistics for unobserved heterogeneity α_{ij} to compute maximum likelihood estimation.

6 Results

6.1 Multinomial Probit Regression Analysis

In this section, we explore the potential reasons that trigger respondents to choose to work part-time in old age. We use multinomial probit model, since the multinomial logit model needs the assumption of independence of irrelevant alternatives (IIA) and multinomial probit model can avoid IIA assumption by not specifying covariance matrix to a diagonal matrix. IIA means that respondents' retirement decision between two working statuses is not affected by adding other working statuses. In other words, if respondents choose between full-time and part-time employment, adding choice of full retirement does not affect their decisions between choices of full-time and part-time employment.

Here, we consider the outcomes as full-time work, part-time work, and full retirement. We exclude the working status "others" in multivariate analyses, because this working status is not related to our analysis. The independent variables contain personal, household and economic characteristics, including age, ethnicity, gender, marital status, education, health, self-employed status, income, total household wealth, pension or annuity income, and number of children. Besides these characteristics, we also include dummy variables of four eligibility age indicators to consider whether eligibility retirement ages for social security benefits are significant predictors on retirement decisions of older Americans. Respondents under early retirement age is categorized as the base group. Moreover, we include four eligibility age indicators for respondents' partners, since Blau (1997) find that social security benefits of partners affect labor force participation on both women and men. Considering economic-related variables, we create several dummy variables to indicate financial conditions of older Americans, including individual labor income, household income, household wealth, pension or annuity, and health insurance. Dummy variable labor income is categorized as high- and low-income earners by average income as the threshold in each wave. The same classification also suits for dummy variable household income and household wealth. In HRS, respondents are asked about the amount of pension or annuity income, and here dummy variable pension or annuity income is categorized by whether respondents receive pension or annuity income. People can buy annuity in a fund or life insurance company and an annuity pays a certain amount of guaranteed income for a period of time. Here, annuity income includes all kinds of annuities, such as fixed-term annuity and life-long annuity. Dummy variable health insurance is categorized by whether respondents are covered by health insurance. As discussed in Section 3.3, we predict self-reported health with a rich set of objective health measures.

In Table 7, five columns present estimation results for three outcomes, and the outcome full retirement is considered as baseline outcome. These results are based on multinomial probit model. Here we use marginal effects to interpret the effects of each explanatory variable.

As we would expect, with advancing age respondents are less likely to stay in the labor force either as part-time workers. When respondents get older, the probability of working part-time decreases by 5.5 percentage point and the probability of full retirement increases by 8.3 percentage point, indicating that respondents have lower probabilities to work part-time and are more likely to retire. This finding is consistent with the de-

scriptive results that there are fewer respondents who work full-time when they are at age 62 or higher ages, and in our sample people have a higher tendency to retire or at least reduce work hours. However, variable age might raise a concern about endogeneity bias, since variable age could be correlated with unobserved variables in the error term. Therefore, we control for quadratic age to verify whether results are consistent. After including quadratic age in the regression, coefficients of covariates are still statistically significant and signs are plausible, and effects of quadratic age are also consistent.

If younger respondents are between early and normal retirement age, the probability of working full-time decreases by 3.9 percentage point. This suggest that respondents between early and normal retirement age are less likely to stay in full-time work, although respondents who claim their benefits as early as age 62 may get a maximum 30% reduction in benefits. When respondents are between normal retirement age and age 70, retirement decision on part-time work is affected. However, since marginal effects are not statistically significant, we cannot conclude how eligibility age indicators of respondents between normal retirement age and age 70 affect part-time work. As presented in Table 7, estimation results show that the retirement behavior of respondents is also affected by eligibility age indicators of their partners. While if partners of respondents are above age 70, those respondents are less likely to stay in part-time work than respondents whose partners are under age 70. One reason stated by Johnson and Favreault (2001) is that if spouses already retired both men and women are more likely to be in retirement.

As expected, the estimates of gender are significant and signs are plausible. The probability of men working full-time is 6.6 percentage point higher than the probability of women, and the probability of men working part-time is 7.7 percentage point lower than the probability of women. This suggests men are more likely to work full-time than women, and men are less likely to work part-time than women. Many research document that on average women are more likely to stay in part-time work than men. Gustman and Steinmeier (2000) contend that men are more likely to be in nonretirement than women at any age. Moreover, Cahill et al. (2015) state that the Early Boomer women are more likely to move into a bridge job than prior generations, and they also find that women often involuntarily leave the labor force with mainly layoffs.

The probability of high-income earners working part-time decreases by 2 percentage point, indicating that high-income earners are less likely to work part-time than low-income earners. High-income earners have higher probability to work full-time than low-income earners. Haider and Loughran (2001) find that high-income earners are more likely to work at older age. One incentive behind this is that when respondents work with high-salary, they are willing to keep their high-salary work to avoid a sharp drop in wage income, since Gustman and Steinmeier (1985) states that when people move into partial retirement they might face a sharp drop on their wage. Thus, for high-income earners they would rather stay in full-time work than part-time work.

Considering for household income, respondents who have high household income have higher probability to work part-time. One possible reason behind this is that if respondents with high household income leave the labor force, their living standards might be affected. Since marginal effects for household income on full-time work is not statistically significant, we cannot know whether respondents with high household income are more likely to stay in the labor force.

Looking at household wealth, the probability of respondents with high household

wealth working full-time decreases by 5.3 percentage point, indicating that respondents with greater household wealth are less likely to work full-time. Haider and Loughran (2001) find that people with greater wealth are less likely to work in old age.

For respondents who have government health insurance, they are less likely to work full-time or part-time, indicating that respondents with pecuniary guarantees of retirement life have a tendency to reduce work hours at older age. For respondents having pension or annuity income, the probability of respondents who work full-time decreases by 9.6 percentage point. This is consistent with results of respondents with government health insurance. The pecuniary guarantee in retirement life is a possible reason of the prevalence to reduce work hours or enter full retirement. However, among respondents who have pension or annuity income, the probability of working part-time increases by 3.3 percentage point, indicating respondents who have pension or annuity income are more likely to work part-time. One possible reason for respondents who have pension or annuity income working part-time is that their pension or annuity income are not adequate for daily expenses, and part-time can bring extra income.

Considering ethnicity, being white decreases the probability of full-time work by 1.9 percentage point. Hudson (2010) find that whites are more likely to follow the traditional one-step retirement, and Hispanics are more likely to stay in the labor force because the limitation of pension eligibility.

Self-employed respondents are more likely to work full-time or part-time, probably because they have discretion over their working statuses or work hours. Cahill et al. (2013) state that self-employment is an important way in post-career transitions of elderly people, meaning that older Americans would choose self-employment as an exit of salary-paid jobs. Respondents have a prevalence to extend working life with self-employment instead of staying in a salary-paid job.

In section 3.3, by applying a fixed effects regression as Coe and Zamarro (2011), we have a more plausible health index than self-reported health statuses, and then we control for endogeneity problem by using a lagged health index. In Table 7, the estimated results are statistically significant for both outcomes and signs are plausible. Respondents with severe health conditions (fair, poor health) are less likely to work part-time or full-time, while healthy respondents are more likely to stay in the labor market at older age (Ross and Mirowsky, 1995). One obvious reason is that respondents with bad health are unable to work. Another possible reason is that employers would not prefer employees with bad health, because those respondents have higher odds for a sick-leave or higher medical subsidies. Under these circumstances, even if respondents with bad health are willing to work, they are less likely to be hired.

Table 7: Multinomial Probit Model Estimation Results

	Mprobit		Marginal Effects		
	Full-time work	Part-time work	Full-time work	Part-time work	Full Retirement
Age	-0.526***	-0.588***	-0.027	-0.055***	0.083***
	(0.159)	(0.138)	(0.020)	(0.020)	(0.019)
Quadratic Age	0.003***	0.004***	0.000	0.000**	-0.001***
	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
EAI2	-0.261***	-0.004	-0.039***	0.023*	0.016
	(0.087)	(0.086)	(0.011)	(0.012)	(0.011)
EAI3	0.208	0.287**	0.006	0.031	-0.037**
	(0.148)	(0.133)	(0.019)	(0.020)	(0.018)
EAI4	-0.027	0.209	-0.023	0.039	-0.016
	(0.254)	(0.213)	(0.034)	(0.034)	(0.029)
EAIP2	-0.130**	-0.091	-0.012	-0.004	0.016*
	(0.065)	(0.063)	(0.008)	(0.009)	(0.008)
EAIP3	-0.036	-0.071	0.001	-0.009	0.008
	(0.074)	(0.069)	(0.009)	(0.010)	(0.009)
EAIP4	-0.238***	-0.276***	-0.011	-0.027**	0.038***
	(0.0830)	(0.077)	(0.011)	(0.011)	(0.010)
Gender	0.255***	-0.313***	0.066***	-0.077***	0.011*
	(0.051)	(0.049)	(0.006)	(0.007)	(0.007)
Education	-0.049	0.050	-0.012*	0.013**	-0.001
	(0.048)	(0.045)	(0.006)	(0.007)	(0.006)
Household Income	0.100*	0.124**	0.004	0.013*	-0.017**
	(0.055)	(0.051)	(0.007)	(0.007)	(0.007)
Household Wealth	-0.534***	-0.305***	-0.053***	-0.006	0.059***
	(0.053)	(0.049)	(0.007)	(0.007)	(0.007)
Individual Income	2.906***	1.368***	0.317***	-0.020***	-0.297***
	(0.0579)	(0.059)	(0.005)	(0.007)	(0.006)
Health Insurance	-0.903***	-0.562***	-0.086***	-0.018*	0.104***
	(0.066)	(0.062)	(0.009)	(0.009)	(0.008)
Pension or Annuity	-0.755***	-0.198***	-0.096***	0.033***	0.064***
	(0.058)	(0.050)	(0.008)	(0.008)	(0.007)
Race	-0.186***	-0.103*	-0.019**	-0.001	0.020***
	(0.058)	(0.056)	(0.007)	(0.008)	(0.007)
Health Index	-1.611***	-1.385***	-0.120***	-0.098***	0.218***
	(0.136)	(0.126)	(0.018)	(0.019)	(0.016)
Self-employment	5.119***	5.150***	0.315***	0.441***	-0.756***
	(0.334)	(0.333)	(0.022)	(0.028)	(0.048)
Number of Child	0.036	0.018	0.004	-0.000	-0.004
	(0.057)	(0.053)	(0.007)	(0.008)	(0.007)
Marital Status	0.043	-0.002	0.007	-0.004	-0.003
	(0.048)	(0.046)	(0.006)	(0.007)	(0.006)
Constant	23.006***	23.058***			
	(-4.777)	(4.209)			
Number of Obs.	14576	14576			

Notes: 1. EAI represents Eligibility age indicators, EAIP represents Eligibility age indicators of partners. EAI(P)2: respondents between early and normal retirement age, EAI(P)3: respondents between normal retirement age and age 70, EAI(P)4: respondents above age 70. 2. Mprobit stands for standard multinomial probit model. 4. *** p<0.01, ** p<0.05, * p<0.10. 4. Standard errors are in parentheses.

6.2 Survival Analysis

In this article, we use the survival analysis to examine the determinants of transitions between three different working statuses across consecutive waves. In multinomial probit model, we analyzed effects of determinants on each working status, and now we investigate transition behaviors of older Americans over two consecutive waves. Six possible transitions are chosen, including transitions from part-time work to full retirement, full-time work to full retirement, full-time work to part-time work, part-time work to full-time work, full retirement to full-time work, and full retirement to part-time work. Three of them are monotonic transitions from a high state of labor force participation to a low state. Here, a low or high labor force participation state is defined by a relative comparison of work hours between two states, and for example transitions from part-time work to full retirement mean moving from a high state of labor force participation to a low state. Another three are reversed transitions, for instance transitions from full retirement to part-time work. The reason why we include three reversed transitions is that we found a substantial number of respondents opt for backward retirement patterns in their retirement life in the descriptive results, meaning that some respondents are willing to return to the labor force after entering full retirement. A backward transition pattern means people work more hours at any given wave than their work hours in initial state.

We use the cox proportional hazard model to analyze determinants of transition patterns. The reason why we choose the cox proportional hazard model is that we do not know the baseline model, and one important advantage for a cox proportional model is that the cox model does not make assumptions about the shape (baseline) of hazard function. If the baseline hazard is mis-specified in the parametric model, the estimation results can be biased. The observed covariates in this regression are the same as the multinomial logistic regression. Table 8 presents the hazard ratio for each covariate in all six transitions. The interpretation of hazard ratio is the percentage of the initial status ending at certain period, and here hazard ratio is the percentage of respondents changing from initial state to another.

Most research find that with advancing age the elderly tends to retire. As expected, older Americans are less likely to move from a state of low to a state of high labor force participation, meaning that older Americans are less likely to make reversed transitions such as transitions from full retirement to a nonretirement status. Given the estimation results of covariate age, older Americans are more likely to make transitions from full-time work to part-time work or full retirement, and in reversed transitions they are less likely to make backward transitions to nonretirement from full retirement at older age. When considering quadratic age, findings are consistent with considering variable age.

Turning to eligibility age indicators of respondents, when respondents are between normal retirement age and age 70, or above age 70, they have lower hazards to make transitions from nonretirement to full retirement. In other words, respondents above normal retirement age are less likely to retire either from full-time or part-time work, and this is possibly due to that people are attracted by delayed social security benefits. Effects of eligibility age for respondents between normal retirement age and age 70 on monotonic transitions are in line with multinomial logistic regression analyses in transitions from part-time work to full retirement. For respondents between normal retirement age and age 70, the hazard ratio of reversed transitions from full retirement to part-time

work is 1.608 and this means respondents in that group are more likely to make reversed transitions from retirement to part-time work. This transition pattern is consistent with transitions from part-time work to full retirement that respondents between normal retirement age and age 70 are less likely to move from part-time work to full retirement.

Furthermore, eligibility age indicators of partners of respondents have effects on some reversed transitions. For respondents whose partners are between early and normal retirement age, the hazard for transitions from retirement to full-time work is below 1, indicating that respondents are less likely to move into a state of high labor force participation when their partners are between early and normal retirement age. Moreover, if partners of respondents are between normal retirement age and age 70, respondents are less likely to make reversed transitions from retirement to part-time work. When partners of respondents are above age 70, respondents are less likely to move from retirement to nonretirement. Therefore, when partners of respondents are above early retirement age, respondents are less likely to increase work hours after moving into retirement or part-time work. In addition, eligibility age indicators of respondents' partners also affect monotonic transition patterns from full-time to part-time work. When partners of respondents are between normal retirement age and age 70, respondents have lower hazards to make transitions from full-time work to part-time work.

Looking at gender, effects are statistically significant in monotonic transitions from full-time work to full retirement or to part-time work. Among men, we find a downward trend for them to move from full-time work to full retirement or part-time work. These findings are in line with Gustman and Steinmeier (2000) that men are more likely to be not retired than women. Gender does not play a significant role in reversed transitions. Besides, the personal characteristics associated with race are found that whites are less likely to make reversed transitions from part-time work or from full retirement to full-time work.

High education does not affect monotonic transitions of respondents, but high education has effects on reversed transitions. In reversed transitions, hazards of moving from part-time work to full-time work increase by 58%, while hazards of moving from full retirement to full-time work increase by 74%. Haider and Loughran (2001) high-educated people are willing to continue to stay in the labor force in old age. One possible reason is that highly educated people have greater job flexibility and job satisfaction which lead them to go back to labor force.

Explanatory variables which relate with respondent' financial conditions are very likely to influence transition patterns of respondents, especially for covariate individual incomes. All six transitions are sensitive to covariate individual income. High-income earners deliver a downward trend on hazards of transitions from full-time work to part-time work or to full retirement, indicating that respondents with high-income are unwilling to give up their high-salary work and move in to a state of lower labor force participation. Schils (2005) finds that high income has negative effects on respondents who move into retirement and receive social security benefits, since those respondents are not satisfied with lower entitlements of social security benefits compared to wage income. On the contrary, high-income earners have higher hazards by 64% in transitions from part-time work to full retirement. We also observed statistically significantly results of high-income earners in reversed transitions. In all three reversed transitions, high-income earners significantly increase the hazard rates of backward transitions, suggesting that

respondents with high-income are more likely to move from a state of lower to a state of higher labor force participation.

Moreover, for respondents with health insurance, the estimation results are not statistically significant in monotonic transitions. For reversed transitions from retirement to part-time work, hazard rates decline if respondents own the health insurance. This means that health insurance increases hazard rates of respondents to leave the labor force. In addition, respondents with pension or annuity income show an upward trend in transitions from full-time work to part-time work or to full retirement. With pension or annuity income, respondents are less likely to make reversed transitions, indicating that respondents would not increase work hours if they are in part-time work or full retirement.

Furthermore, among respondents with high household wealth they are less likely to move from part-time work to full retirement. However, when considering reversed transitions, respondents with high household wealth are less likely to make transitions from full retirement to part-time work. One possible reason for this contradiction is that respondents who have greater household wealth are less likely to move to another states. Overall, characteristics which relate with financial conditions of respondents deliver a consistent trend that respondents with financial guarantees in retirement life are more likely to make transitions to a state of lower work hours, however, high-salary respondents are less likely to give up high-salary work or move into a state of less work hours.

Self-employed respondents show a different transition pattern with wage-and-salary respondents. Explanatory variable "self-employment" is significant in five transitions, except reversed transitions from part-time to full-time work. Self-employed workers are less likely to move from full-time work into part-time work or into full retirement than a wage-and-salary worker in all three monotonic transitions. Self-employed respondents are less likely to make transitions from part-time work to full retirement. In addition, self-employed respondents are more likely to make reversed transitions. For example, self-employed respondents significantly increase hazards of transiting from full retirement to full-time or to part-time work. To conclude, self-employed respondents are willing to return to the labor force after retirement, and they are less likely to reduce work hours.

Furthermore, health conditions also affect transitions between working statuses across consecutive waves. As expected, respondents with bad health conditions have a higher chance of making transitions from nonretirement to full retirement, and in reversed transitions bad health conditions of respondents reduce hazards of moving back to a state of higher labor force participation. Schils (2005) states that people with a bad state of health are more likely to leave the labor force, since they might have lower life expectancy and low productivity at work. These findings are in line with findings in multinomial logistic regression analyses that respondents with poor health conditions are more likely to be in full retirement.

Table 8: Hazard Ratio of six transitions

Transitions	PR	FR	FP	PF	RF	RP
Age	1.030	1.191***	1.196***	1.050	0.745***	0.772***
	(0.032)	(0.032)	(0.057)	(0.089)	(0.079)	(0.047)
Quadratic Age	1.000	1.000	0.999*	0.999	1.002**	1.002***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)
EAI2	0.899	0.982	1.170	0.747	1.017	1.035
	(0.123)	(0.126)	(0.162)	(0.331)	(0.309)	(0.157)
EAI3	0.690*	0.709*	1.110	0.589	1.312	1.608*
	(0.198)	(0.201)	(0.255)	(0.466)	(0.447)	(0.244)
EAI4	0.487**	0.514**	1.074	0.252	0.416	1.433
	(0.285)	(0.294)	(0.372)	(0.913)	(0.900)	(0.358)
EAIP2	1.149	1.101	0.906	0.701	0.567**	0.831
	(0.092)	(0.093)	(0.124)	(0.252)	(0.257)	(0.125)
EAIP3	1.141	0.974	0.744**	0.829	0.781	0.726**
	(0.108)	(0.109)	(0.149)	(0.266)	(0.268)	(0.151)
EAIP4	1.085	1.048	0.819	0.694	0.474**	0.598***
	(0.121)	(0.121)	(0.168)	(0.336)	(0.343)	(0.171)
Gender	1.114	0.808***	0.778***	1.207	0.868	1.006
	(0.076)	(0.075)	(0.096)	(0.192)	(0.191)	(0.098)
Education	0.893	0.917	0.972	1.577**	1.735***	1.061
	(0.070)	(0.071)	(0.093)	(0.180)	(0.175)	(0.090)
Household Income	0.931	0.951	1.083	1.037	0.949	1.226**
	(0.076)	(0.076)	(0.106)	(0.191)	(0.194)	(0.101)
Household Wealth	0.862*	0.963	1.000	0.892	0.858	0.779**
	(0.078)	(0.079)	(0.102)	(0.182)	(0.174)	(0.0982)
Individual Income	1.639***	0.624***	0.311***	1.597**	4.102***	1.984***
	(0.077)	(0.079)	(0.106)	(0.190)	(0.198)	(0.107)
Health Insurance	0.876	0.931	1.092	1.505	0.753	0.622***
	(0.106)	(0.103)	(0.136)	(0.239)	(0.227)	(0.138)
Pension or Annuity	0.879	1.260**	1.317**	0.498***	0.409***	0.742**
	(0.094)	(0.093)	(0.119)	(0.268)	(0.269)	(0.119)
Race	1.068	1.149	1.204	0.659**	0.613***	1.016
	(0.088)	(0.089)	(0.117)	(0.180)	(0.181)	(0.116)
Health Index	2.539***	2.583***	1.006	1.145	0.132***	0.219***
	(0.196)	(0.200)	(0.288)	(0.526)	(0.509)	(0.268)
Self-employment	0.767***	0.721***	0.519***	0.849	3.109***	5.066***
	(0.090)	(0.096)	(0.130)	(0.187)	(0.197)	(0.124)
Number of Child	1.056	1.007	1.067	1.186	1.218	1.135
	(0.083)	(0.083)	(0.109)	(0.202)	(0.194)	(0.109)
Marital Status	1.018	1.018	0.999	1.073	1.032	1.021
	(0.026)	(0.026)	(0.041)	(0.063)	(0.061)	(0.039)

Notes: 1. EAI represents Eligibility age indicators, EAIP represents Eligibility age indicators of partners. EAI(P)2: respondents between early and normal retirement age, EAI(P)3: respondents between normal retirement age and age 70, EAI(P)4: respondents above age 70. 2. F = Full-time work; P = Part-time work; R = Completely Retired. 3. *** p<0.01, ** p<0.05, * p<0.10. 4. Standard errors are in parentheses.

6.3 Duration Analysis

In this section, we explore determinants that trigger respondents to stay longer in part-time work by using Ordinary Least Square estimation (OLS). Given the Kaplan-Meier analysis, half of respondents would like to stay in part-time work for one wave (2 years) and then at the end of the observation period (8 years) there are still about 25% of respondents who remain in part-time work. Burtless (1986) states that the average stay in part-time work or phased retirement is about 3 years, and Ruhm (1990) calculates the duration time of partial retirement is 2.62 years.

In order to estimate the duration of part-time work, only respondents who already stay in part-time work for at least one wave (2 years) are considered in this analysis. Thus response variables for duration in part-time work should be one, two, three, and four waves (2, 4, 6, 8 years). When analyzing duration time of each respondent in part-time work, we only consider the longest consecutive stay in part-time work. For example, if respondents work part-time in the first two waves, work full-time in third wave, and then move back to part-time work in last two waves (PPFPP), we would consider the duration time in part-time work as two waves (4 years) rather than four waves (8 years). We keep explanatory variables the same as previous analyses with the household, economic, and personal characteristics of respondents. In Table 9, we summarize estimation results of relationship between observed explanatory variables and duration time in part-time work. Eligibility age indicators of respondents, gender, total household income, individual income, health insurance, health index, self-employment, number of children, age, quadratic age, and marital status are statistically significant at the conventional statistical significance levels.

Some of the relationships between observed covariates and duration in part-time work that we find are not surprising. For example, with advancing age, respondents are less likely to stay longer in part-time work at older age. Moreover, respondents with severe health conditions are less likely to stay in part-time work for a longer period. In multinomial probit model, respondents with bad health are less likely to work full-time or part-time in the labor force. In addition, self-employed respondents are more likely to stay longer in part-time work, possibly because they manage their work hours with more flexibility.

If respondents are between normal retirement age and age 70, this eligibility age indicator presents negative effects on duration in part-time work, meaning that when respondents are between normal retirement age and age 70 they would not stay long in part-time work. Eligibility age indicators for partners of respondents do not affect the duration in part-time work.

Considering gender effect, men are less likely to stay longer in part-time work than women. Ruhm (1990) finds that women change their occupations less frequent than men, and the main reason for this infrequent change is limited job opportunities for women.

In duration analysis, financial conditions of respondents have different effects on duration in part-time work. Respondents with high household income tend to stay longer in part-time work, however respondents with high individual income are less likely to stay longer. Moreover, respondents with government health insurance have lower possibilities to stay longer in part-time work. In conclusion, respondents with better financial conditions are unwilling to stay long in part-time work except for respondents with high

Table 9: Duration Analysis

	Coef.		Coef.
EAI2	-0.070	Individual Income	-0.209***
	(0.055)		(0.035)
EAI3	-0.165**	Health Insurance	-0.077*
	(0.083)		(0.043)
EAI4	-0.182	Pension or Annuity	0.053
	(0.115)		(0.035)
EAIP2	0.023	Race	-0.044
	(0.041)		(0.037)
EAIP3	0.001	Health Index	-0.402***
	(0.046)		(0.083)
EAIP4	-0.078	Self-employment	0.788***
	(0.052)		(0.042)
Gender	-0.272***	Number of Child	-0.0707**
	(0.031)		(0.036)
Education	0.039	Age	-0.051***
	(0.029)		(0.019)
Household Income	0.091***	Quadratic Age	0.000657***
	(0.033)		(0.000)
Household Wealth	0.007	Marital Status	-0.022*
	(0.032)		(0.012)

Notes: 1. EAI represents Eligibility age indicators, and EAIP represents Eligibility age indicators of partners. 2. Linear regression model with fixed effects. 3. *** p<0.01, ** p<0.05, * p<0.10. 4. F-test is presented with p value.

household income.

Looking at family size of respondents, there is a negative correlation between duration in part-time work and respondents with larger family size. Here respondents with larger family size indicates respondents who have more than four children. One possible reason for this negative relationship is that respondents with more than four children may have more grandchildren, and they are more engaged with household activities. Thus, respondents with larger family size cannot stay longer in the labor force even as part-time workers. Likewise, marital status also imposes negative effects on duration in part-time work, suggesting that respondents with partners are less likely to stay longer in part-time work. Henretta et al. (1993) find linkage between retirement patterns among couples that husbands are affected by current working statuses of their spouses, and when their spouses retried husbands also tend to retire.

Table 10: Percentage reporting Two Modes of Part-time Employment

	Wave 8				Wave 10				Wave 12			
	A	B	C	D	A	B	C	D	A	B	C	D
WPT	9.95	6.60	4.44	0.00	11.11	5.78	3.49	3.19	10.87	5.61	2.92	1.92
PTR	4.76	13.86	16.24	0.00	3.87	11.03	15.27	14.34	4.34	9.76	12.97	13.31

Notes: 1. Groups A, B, C, and D stand for four groups. Group A: respondents under early retirement age; Group B: respondents between early retirement age and normal retirement age; Group C: respondents between normal retirement age and age 70; Group D: respondents above age 70. 2. WPT = Working less than 35 hours per week and not mentioning about retirement, PTR = Working less than 35 hours per week and mentioning about retirement.

7 Robustness Check

7.1 Definition of Part-time Employment

As discussed in Section 3.1, we use self-perceived labor force statuses based on HRS definition. In this article, part-time work is defined as a reduction of work hours per week and not considering whether respondents mention about retirement. HRS provides a more detailed categorization as "working part-time" and "partly retired" by measuring whether respondents mention about retirement. Table 4 presents percentages of respondents doing part-time work in each wave in different groups, and there is an upward trend for respondents to be in part-time work before age 70. Here, we consider two modes of part-time employment separately to examine retirement trends among respondents who work less than 35 hours per week.

Table 10 shows percentages of respondents being in "working part-time" and "partly retired" in each wave across groups. With two modes of part-time employment, proportions of respondents "working part-time" decrease across groups, while proportions of "partly retired" respondents first increase substantially for group of respondents under age 70 and then decrease in each wave. This suggests that among respondents who work less than 35 hours per week, percentages of them not mentioning about retirement decrease across groups. The trend of "partly retired" respondents is in line with the finding in Section 4.1 that proportion of respondents being in part-time work first increases with groups, and then declines when respondents who are above age 70. Furthermore, except in group **A**, percentages of respondents "working part-time" are lower than that of "partly retired" respondents in group **B, C, D**. A possible reason is that when respondents are above early retirement age, they are more aware of retirement and more respondents report themselves as retirement.

7.2 Econometric Model

We have used multinomial probit model to investigate effects of several determinants on retirement decisions of older Americans, especially on part-time employment. One reason of using multinomial probit model is to avoid IIA assumption, since based

on estimates in Table 11 the IIA assumption for multinomial logit model has been violated. IIA means that respondents' retirement decision between two working statuses is not affected by other working statuses. However, Dow and Endersby (2004) contend that multinomial logit model is always preferable than more complex multinomial probit model, since multinomial probit model may raise some serious problems which are hard to detect, such as weak identification. Cheng and Long (2007) argue that hausman test reject IIA assumption when outcomes seem distinct, and IIA assumption often fail to be rejected when outcomes can be reasonably treated as close substitutes. Moreover, Cheng and Long (2007) contend that tests of IIA assumption is unsatisfactory in application when analyzing a restricted choice set. Thus, we use multinomial logit model to examine whether effects of each covariate on retirement decisions of respondents are consistent with multinomial probit model.

In Table 12, we present estimation results of multinomial logit model on full-time work and part-time work in first two columns, and another two columns present estimation results of multinomial probit model. Covariates which are significant in multinomial probit model are also significant in multinomial logit model. Signs are plausible and consistent. The magnitudes of level effects of each covariate increase slightly when we use multinomial logit model.

However, there is a still potential problem of unobserved heterogeneity, since observed covariates can be related with unobserved heterogeneity. García-Pérez et al. (2013) state that if variable minimum pension income for unemployed people is omitted retirement effects of disposal income on retirement behaviors are underestimated. This suggests the estimates may be inconsistent or biased because of unobserved heterogeneity. Since the estimation results in multinomial logit model are consistent with multinomial probit model and multinomial logit model is more flexible than multinomial probit model, we use multinomial logit model with fixed effects to control for omitted variable bias.

Table 13 and 14 present the estimation results for full-time and part-time work using multinomial logit model without and with fixed effects. In those two models, we use odds ratios to interpret the effects of each explanatory variable, since in multinomial logit model with fixed effects marginal effects cannot be estimated. The odds ratio represents the effect of factor change (from 0 to 1) in explanatory variables, which means that a positive (negative) coefficient leads to an odds ratio greater (smaller) than one. In other words, if the explanatory variable has no effect on dependent variable, the corresponding odds ratio would be 1.

After using multinomial logit model with fixed effects, three explanatory variables are omitted because of no within group variance across time for each individual. These omitted variables are gender, education, and race, which have to be not changed over time. Some explanatory variables lose explanatory power after controlling for unobserved heterogeneity. This suggests that unobserved characteristics of respondents correlate with their labor force statuses. Furthermore, effects of observed variables on retirement outcomes are consistent with multinomial logit model with and without fixed effects, but effects of multinomial logit model with fixed effects are generally less strong than multinomial logit model without fixed effects.

Based on odds ratio in Table 13 and 14, we find some exceptional results compared with effects in multinomial probit model. In multinomial logit model, eligibility age indicator of respondents between normal retirement age and age 70 are statistically significant

Table 11: Hausman Test

Base	χ^2	Degree of Freedom	P> χ^2
Full-time Work	212.18	20	—
Part-time Work	226.41	20	—
Full Retirement	-3.81	20	—

Notes: if χ^2 <0, the estimated model does not asymptotic assumption of the test.

for outcome part-time work. We find that respondents between normal retirement age and age 70 are more likely to work part-time than retire fully. One possible reason could be that Americans can delay to claim their social security benefits until the age of 70 and acquire the largest benefit, but the benefit increase could not be applied to people above age 70. Moreover, high-income earners are more likely to be in full-time and part-time work than full retirement. For respondents who have pension or annuity income, they are less willing to be in full-time or part-time work. These two findings are contradicted with multinomial probit model. One possible reason for these contradictions is that we use different ways to interpret estimation results.

Table 12: Multinomial Logit and Probit Model Estimation Results

	Mlogit		Mprobit	
	Full-time work	Part-time work	Full-time work	Part-time work
Age	-0.644***	-0.743***	-0.526***	-0.588***
	(0.216)	(0.187)	(0.159)	(0.138)
Quadratic Age	0.004**	0.005***	0.003***	0.004***
	(0.002)	(0.002)	(0.001)	(0.001)
EAI2	-0.359***	-0.027	-0.261***	-0.004
	(0.118)	(0.114)	(0.087)	(0.086)
EAI3	0.273	0.386**	0.208	0.287**
	(0.202)	(0.180)	(0.148)	(0.133)
EAI4	-0.024	0.310	-0.027	0.209
	(0.348)	(0.290)	(0.254)	(0.213)
EAIP2	-0.161*	-0.130	-0.130**	-0.091
	(0.086)	(0.084)	(0.065)	(0.063)
EAIP3	-0.043	-0.103	-0.036	-0.071
	(0.099)	(0.092)	(0.074)	(0.069)
EAIP4	-0.300***	-0.349***	-0.238***	-0.276***
	(0.112)	(0.103)	(0.0830)	(0.077)
Gender	0.365***	-0.430***	0.255***	-0.313***
	(0.070)	(0.067)	(0.051)	(0.049)
Education	-0.063	0.046	-0.049	0.050
	(0.065)	(0.060)	(0.048)	(0.045)
Household Income	0.161**	0.176**	0.100*	0.124**
	(0.074)	(0.069)	(0.055)	(0.051)
Household Wealth	-0.726***	-0.436***	-0.534***	-0.305***
	(0.072)	(0.067)	(0.053)	(0.049)
Individual Income	3.864***	1.936***	2.906***	1.368***
	(0.0829)	(0.0848)	(0.0579)	(0.059)
Health Insurance	-1.201***	-0.765***	-0.903***	-0.562***
	(0.087)	(0.082)	(0.066)	(0.062)
Pension or Annuity	-1.052***	-0.268***	-0.755***	-0.198***
	(0.080)	(0.067)	(0.058)	(0.050)
Race	-0.232***	-0.145**	-0.186***	-0.103*
	(0.078)	(0.074)	(0.058)	(0.056)
Health Index	-2.221***	-1.848***	-1.611***	-1.385***
	(0.184)	(0.170)	(0.136)	(0.126)
Self-employment	8.592***	8.551***	5.119***	5.150***
	-1.003	-1.002	(0.334)	(0.333)
Number of Child	0.044	0.015	0.036	0.018
	(0.077)	(0.071)	(0.057)	(0.053)
Marital Status	0.065	-0.002	0.043	-0.002
	(0.064)	(0.061)	(0.048)	(0.046)
Constant	29.102***	29.665***	23.006***	23.058***
	(6.476)	(5.704)	(-4.777)	(4.209)
Number of Obs.	14576	14576	14576	14576

Notes: 1. EAI represents Eligibility age indicators, EAIP represents Eligibility age indicators of partners. EAI(P)2: respondents between early and normal retirement age, EAI(P)3: respondents between normal retirement age and age 70, EAI(P)4: respondents above age 70. 2. Mlogit stands for standard multinomial logit model, Mprobit stands for standard multinomial probit model. 4. *** p<0.01, ** p<0.05, * p<0.10. 4. Standard errors are in parentheses.

Table 13: Multinomial Logit Model Estimation Results

	Mlogit		Odds Ratio	
	Full-time work	Part-time work	Full-time work	Part-time work
Age	-0.644***	-0.743***	0.525	0.476
	(0.216)	(0.187)		
Quadratic Age	0.004**	0.005***	1.004	1.005
	(0.002)	(0.002)		
EAI2	-0.359***	-0.027	0.698	0.973
	(0.118)	(0.114)		
EAI3	0.273	0.386**	1.314	1.471
	(0.202)	(0.180)		
EAI4	-0.024	0.310	0.976	1.364
	(0.348)	(0.290)		
EAIP2	-0.161*	-0.130	0.851	0.878
	(0.086)	(0.084)		
EAIP3	-0.043	-0.103	0.958	0.902
	(0.099)	(0.092)		
EAIP4	-0.300***	-0.349***	0.740	0.705
	(0.112)	(0.103)		
Gender	0.365***	-0.430***	1.441	0.650
	(0.070)	(0.067)		
Education	-0.063	0.046	0.939	1.047
	(0.065)	(0.060)		
Household Income	0.161**	0.176**	1.175	1.193
	(0.074)	(0.069)		
Household Wealth	-0.726***	-0.436***	0.484	0.646
	(0.072)	(0.067)		
Individual Income	3.864***	1.936***	47.646	6.928
	(0.083)	(0.085)		
Health Insurance	-1.201***	-0.765***	0.301	0.466
	(0.087)	(0.082)		
Pension or Annuity	-1.052***	-0.268***	0.349	0.765
	(0.080)	(0.067)		
Race	-0.232***	-0.145**	0.793	0.865
	(0.078)	(0.074)		
Health Index	-2.221***	-1.848***	0.109	0.158
	(0.184)	(0.170)		
Self-employment	8.592***	8.551***	5385.762	5172.242
	-1.003	-1.002		
Number of Child	0.044	0.015	1.045	1.015
	(0.077)	(0.071)		
Marital Status	0.065	-0.002	1.067	0.998
	(0.064)	(0.061)		
Constant	29.102***	29.665***	4.35e+12	7.65e+12
	(6.476)	(5.704)		
Number of Obs.	14576	14576		

Notes: 1. EAI represents Eligibility age indicators, EAIP represents Eligibility age indicators of partners. EAI(P)2: respondents between early and normal retirement age, EAI(P)3: respondents between normal retirement age and age 70, EAI(P)4: respondents above age 70. 2. Mlogit stands for standard multinomial logit model. 4. *** p<0.01, ** p<0.05, * p<0.10 4. Standard errors are in parentheses.

Table 14: Multinomial Logit Model with Fixed Effects Estimation Results

	Femlogit		Odds Ratio	
	Full-time work	Part-time work	Full-time work	Part-time work
Age	0.081	-0.688	1.084	0.503
	(0.516)	(0.434)		
Quadratic Age	-0.005	0.003	0.995	1.003
	(0.004)	(0.003)		
EAI2	-0.943***	-0.197	0.390	0.821
	(0.270)	(0.256)		
EAI3	-0.358	-0.282	0.699	0.755
	(0.439)	(0.391)		
EAI4	0.116	0.282	1.123	1.325
	(0.688)	(0.559)		
EAIP2	0.158	0.063	1.171	1.065
	(0.248)	(0.229)		
EAIP3	-0.111	-0.137	0.895	0.872
	(0.394)	(0.340)		
EAIP4	-0.179	-0.458	0.836	0.632
	(0.544)	(0.459)		
Gender	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Education	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Household Income	0.223	0.008	1.249	1.008
	(0.198)	(0.183)		
Household Wealth	-0.406	-0.001	0.667	0.999
	(0.250)	(0.229)		
Individual Income	1.483***	0.622***	4.406	1.862
	(0.201)	(0.201)		
Health Insurance	-0.882***	-0.128	0.414	0.880
	(0.245)	(0.213)		
Pension or Annuity	-0.732***	-0.385**	0.481	0.680
	(0.230)	(0.196)		
Race	(Omitted)	(Omitted)	(Omitted)	(Omitted)
Health Index	-1.916*	-0.878	0.147	0.416
	(1.097)	(0.997)		
Self-employment	19.602	20.206	3.26e+08	5.96e+08
	(541.700)	(541.700)		
Number of Child	0.585	1.036	1.795	2.817
	(0.719)	(0.703)		
Marital Status	-0.134	0.421	0.874	1.523
	(0.432)	(0.418)		
Number of Obs.	6227	6227		

Notes: 1. EAI represents Eligibility age indicators, EAIP represents Eligibility age indicators of partners. EAI(P)2: respondents between early and normal retirement age, EAI(P)3: respondents between normal retirement age and age 70, EAI(P)4: respondents above age 70. 2. Femlogit stands for multinomial logit model with fixed effects. 3. *** p<0.01, ** p<0.05, * p<0.10. 4. Standard errors are in parentheses.

8 Conclusion

Older Americans tend to live longer and are healthier compared with prior cohorts. With the aging society in United States, it is unavoidable for older Americans to participate in the labor force, because of increasing financial burden of the social security system and needs of the labor force. This article analyzed various aspects of the retirement behavior of part-time workers and compared it that of full-time workers and retirees. This article first examines four descriptive facts of older Americans ranging from age 50 to 75 in period 2006 to 2014 (wave 8 to 12). Secondly, three regression analyses are used to determine effects of personal, household, and economic characteristics on three retirement outcomes (full-time work, part-time work, and full retirement). We analyze determinants of prevalence of older Americans in nonretirement using multinomial probit model. And a cox proportional hazard model is used to analyze effects of observed characteristics on transitions between three working statuses across consecutive waves. Moreover, we use Ordinary Least Square to examine which determinants trigger respondents to stay longer in part-time work.

The labor force in United States is aging, and in order to tackle this normal retirement age is prolonged and adjusted by year of birth. First, this article provides a look at effects of postponed normal retirement age on decisions of retirement patterns. Besides, we also include early retirement age and age 70 to indicate effects of reduced benefits of early retirement and increased benefits of late retirement. Thus, we create four eligibility age indicators for respondents and their partners to examine whether retirement decisions on part-time employment are affected by eligibility retirement age for social security benefits. Main findings from eligibility age indicators of respondents and their partners are that respondents between early and normal retirement age are unwilling to stay in full-time work, although they might get a maximum 30% reduction in benefits when they retire as early as age 62. When considering transitions between two consecutive waves, respondents between normal retirement age and age 70 have a low chance to make transitions from nonretirement states to full retirement. A possible explanation is that Americans can delay to claim social security benefits until age 70. Moreover, retirement patterns of older Americans are also affected by eligibility age indicators of their partners. If partners of respondents are above age 70, respondents are less likely to work part-time. It may be that couples would like to retire together and in order to in line with their partners those respondents might change their retirement plans (Johnson et al., 2004). Eligibility age indicators of respondents' partners have negative effects on reversed transitions from full retirement to part-time work. Furthermore, respondents between normal retirement age and age 70 have negative effects on lengthening the duration in part-time work.

Second, considering characteristics which relate with financial conditions of respondents, respondents with greater wealth or financial guarantees in retirement life are more likely to fully retire, except for respondents who have high individual income or household income. Surprisingly, respondents with high salary and high household income are more likely to be in full-time work, and a tentative explanation is that they do not want a sharp drop in their salaries to compromise their living standards. Another main finding is that respondents with high individual income are more likely to move from part-time work to full retirement, but they are less likely to work part-time. However, respondents with high

household income or those who have pension or annuity tend to retire gradually with the use of part-time work. Moreover, respondents with high individual income have higher hazard rates in making reversed transitions. For other characteristics, pension or annuity income and government health insurance significantly increase the hazards in monotonic transitions from a state of high work hours to a state of low work hours, or reduce the hazards in corresponding reversed transitions. In addition, there is a downward trend for high-income earners and respondents with health insurance to stay longer in part-time work.

Third, we also include a lagged health index as a replacement of self-reported health in order to control for justification problem and unobserved heterogeneity. As we would expect, respondents with bad health conditions are less likely to work either full-time or part-time.

In conclusion, respondents with high household income or those who have pension or annuity tend to retire gradually with the use of part-time work. Among respondents who are between normal retirement age and age 70, they are less likely to make transitions from part-time work to full retirement. However, when respondents' partners are above age 70 respondents are unwilling to work part-time and these respondents are less likely to make reversed transitions from full retirement to part-time work. In addition, respondents at good financial conditions are unwilling to stay longer in part-time work, but respondents with high household income are exceptions. Furthermore, respondents with bad health conditions are less likely to stay in the labor force.

In all three regression analyses, we found financial conditions of the elderly largely affected people's choices on retirement patterns. We examine effects of respondents who have pension or annuity income and respondents who do not have, but we did not consider effects of different types of pension plans. Pension plans are usually classified as defined benefits (DB) and defined contribution (DC). In the United States, the legislation changes in past decades make DB plans less attractive to employers, and Towers Watson (2012) states that a large number of employers have changed into DC plans. It might be useful to consider these two pension plans to further analyze effects of financial conditions on retirement life of older Americans.

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