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Title; Health Consequences of Transitioning to Retirement and Social Participation: Evidence from JSTAR panel data

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Despite of an extensive amount of published economic, psychological, and public health research, a consensual view on the causal relationship between retirement and health remains to be articulated. This lack of consensus is arguably due to the diversity in the transitional process from employment to full retirement, the usage of various characteristics of health outcome measures, social and economic conditions affecting the retirement decision, and the impact of crowding-out by activities substituting to formal work role (e.g., participation to the community network). We used panel data from the Japanese Study of Aging and Retirement (JSTAR) to fill the knowledge gap by scrutinizing the complex relationships among work status transition, social participation, and health conditions. We confirmed that transitioning from employment to retirement is a diverse and gradual process with distinct gender-related aspects. Social participation to informal community network is significantly related to exiting formal work situations for men, but not for women. Propensity-matched difference-in-difference analysis revealed that cognitive function declines after leaving paid work in male retirees, but not in female ones. The impact on cognitive function is significant when the retiree left work engagement with full-time basis, with less job stress, and with expected job security. Otherwise the decline was not significant. These results basically support the role theory of life transitions, and indicate that policies on work and health in the elderly population should facilitate retiree's gradual transitions of social roles diversifying according to ones' work characteristics, economic and social needs, and gender roles in the household.
Key words: retirement, cognitive function, social network participation, gender difference, panel data, propensity-matched difference-in-difference analysis JEL classification: I12, J14, J26

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I. Background

Retirement and retiree health status have been investigated by a large number of studies in the economics, psychological, and public health literature. However, a consensus on the causal relationship between retirement and health has not been reached. In the face of aging populations and increasing fiscal pressure from pensions for the elderly, economists have long been interested in health as human capital affecting retirement decisions [Gupta and Larsen 2010, Ichimura and Shimizutani 2012]. Recently, the impact of retirement on health has also been reported in the economic and public health literature [Behncke 2012; Bound 1989; Bound and Waidman 2007; Coe and Zammaro 2011; Dave, Rashad, and Spasojevic 2006; Fe and Hollingsworth 2011; Gallo, Bradley, Siegel and Kasl 2000; Lindeboom and Lindegaard 2010; Mojon-Azzi, Sousa-Poza, and Widmer 2007; Moon Glymour Suburamanian, Avendano, and Kawachi 2012; Sjo¨sten, Kivima¨ki, Singh-Manoux, et al. 2012; Westerlund Vahtera, Ferrie, et al. 2010; Zins, Gueguen, Kivimaki, et al. 2011].

Economists often use human capital theory to model the effect of retirement on health [Grossman 1972]. Because the Grossman model treats wage rate as a reflection of time cost and individual economic productivity, model implications for health investment after leaving paid work are somewhat vague [Dave, Rashad, and Spasojevic 2006]. Alternatively, psychologists who study retirement adjustment often rely on “role theory” and “life course theory” [Wang, Henkens, and van Solinge, 2011]. These theories regard retirement as a transition from the loss of work-related roles (e.g., as worker, or as organizational member) to the strengthening of other roles in the family and the community. Transitions in social roles affect wellbeing because social interaction exercised in different roles affects access to economic, psychological and social resources for health maintenance [Mein, Higgs, Ferrie, and Stansfeld 1998]. Studies on social relationship and elderly wellbeing have consistently found that elderly people who enjoy frequent social interaction have better physical, mental, and cognitive prognoses, and better survival after illness [Sugisawa, Sugisawa, Nakatani, and Shibata 1997: Sirven and Debrand 2008]. Consistent with the role theory, labor participation in later life could be beneficial because it allows access to economic investment in health, and provides opportunities for health-generating social participation.

One could argue, however, whether all types of labor participation can be health generating. Some types of labor have a deleterious effect on health (e.g., jobs with higher stress, hazardous toxic exposure, and excessive physical strain). Models published in the economic and social psychological literature have mostly failed to incorporate differences in retirement-health association across occupational types. In their panel survey of UK civil servants, Mein et al. (2003) included these differences and found that retirement was related to stress reduction for higher occupational classes, but not for lower occupational classes. Their study results also indicated that the types of health stock (e.g., physical, mental, cognitive, functional and social aspects) may be differently affected by

retirement, depending on the nature of pre-retirement occupational types and required capability.

In this discussion paper, we intended to add evidence on the ongoing discussion over health impact of work status transition in one's later life by use of a panel data derived from the Japanese Study of Ageing and Retirement (JSTAR). JSTAR interviews consist of questions about current employment status, type of employment, reasons for retirement, job stresses, and various measures of health (e.g., functional, cognitive, and mental). A supplemental questionnaire is used to collect information about social support, social networks, the types and frequencies of social participation, and perceived social capital. The rich data of the JSTAR would enable us to specify the causal impact of work status transitions onto health.

We begin the next section with a descriptive statistical analysis of work status transition from wave 1 to wave 2. The analysis was performed using stratification by gender because patterns of work status trajectory displayed distinct between-gender differences (i.e., female respondents viewed homemaker status as an alternative status to retirement). Description of the trajectory patterns helped us confirm that retirement is a gradual process, and that the treatment of homemaker status is problematic among females. Participation in different types of social networks was compared across work status trajectory categories to investigate whether social participation and labor participation endogenously affect each other. Interestingly, we found gender differences in the association between leave work status and participation in social networks. Retired male respondents were more likely to participate in voluntary and leisure activities. There were no significant associations with social participation among retired females or among homemakers. The results suggest that in males, the pattern of social participation may confound the health effect of retirement. With the results of descriptive analysis above, we conducted a propensity matched difference-in-difference analysis that revealed cognitive function is significantly declined among males who left paid work status, but the impact was not observed in females. Adhoc stratified analysis among male workers further identified that cognitive decline was only remarkable in males engaging with fulltime job, less job stress, and expected job security. These results are in accordance with the role theory, indicating that the causal relationship of labor participation onto health is conditional on gender roles, job characteristics. In the final section, we discuss policy implication of our results to form labor and health policy for the people in their mid to later life.

II. Descriptive analysis of transition in work status transition and social participation in the JSTAR population

II-1. Definition of retirement and work status transitions between wave 1 and wave 2

JSTAR interviewers ask whether the respondent currently participates in the labor force, including tentative leave. If the respondent answers NO, a follow-up question asks whether he/she is currently

seeking employment opportunities. If the answer to this question is YES, the respondent is categorized as "unemployed." If the answer is NO, the respondent is asked to choose the category that best describes his/her current status: "retired", "homemaker", "convalescent", or "other".[1]

Table 1-1 presents the trajectory of work status transition between waves 1 and 2 for both genders and for all age categories. Tables 1-2 and 1-3 present the results of a stratified analysis for male and female respondents. There was a 20–30% loss to follow-up in each category. Gender differences were observed in the attrition rate among retirees and homemakers at the time of wave 1; male homemakers and female retirees were likely to drop out of follow-up survey.

For both genders, respondents with full-time, part-time, and self-employed labor participation status were most likely to remain in the same category after two years. Striking gender differences were observed for the categories of "other employment", "unemployment", "retired", and "homemakers" at the wave 1 study period. Males in other employment or unemployment during wave 1 had the highest proportion of retirement during wave 2 (24.0% and 29.6%, respectively), followed by part-time workers (10.0%). Female retirement rate was less than 2% in all categories. Females in other employment were most likely to stay in the same category after two years, and females unemployed at wave 1 were most likely to become homemakers at wave 2 (32.6%). An unexpected finding was that 47.4% of females who defined themselves as retired at wave 1 returned to homemakers at wave 2. The descriptive analyses results presented in Tables 1s suggest that males transited to retirement via other employment, unemployment, and part-time status. Female respondents were more flexible in the use of homemaker status interchangeably with retirement status.

JSTAR also asks whether respondents were re-hired after compulsory retirement. About one-half of male respondents who were in full-time employment at wave 1 and have transitioned to a part-time position at wave 2 were re-hired (not shown in tables). About 22% of these re-hired males transited from part-time to part-time positions. In contrast, only a quarter of the female respondents who transitioned from full-time to part-time positions were re-hired cases. A considerable proportion of males transited to retirement through non-full time positions instead of shifting directly to retirement. Females take a different path to retirement.

To summarize, the descriptive analysis findings presented in this section were:

1. Retirement is a gradual process rather than a discrete event.
2. Males and females take different paths to retirement. Males use part-time and other work status

[1] Ichimura and Shimizutani [2012] further used self-reported work time for formal paid work as a marker for "retirement" because of inconsistencies in self-reported retirement. We did not use this strategy because we defined retirement more broadly than "leaving formal labor force."
However, there may be some misclassification of status because some respondents indicated they were "at work" even though they were only working a few hours per day.

conditions as a transit from fulltime to full retirement from paid work. Among females, change to homemaker status is used as an alternative to full retirement.

II-2. Descriptive analysis of work status transition and change in social participation

JSTAR asks respondents if they participate in social relationships other than with family, relatives, and friends, or in social settings other than the workplace. We performed a multiple correspondence analysis (a multivariate statistical technique for categorical data) to reduce the questionnaire's eight types of social network participation to a smaller number of categories. The resulting categories were "commitment", "prestige", and "preference-based" networks. Commitment network participation reflects activities such as volunteer activities in the community and other commitments that support the neighborhood. Prestige network participation consists of political and/or religious activities. Preference-based network participation includes sports, leisure, hobby, and learning activities.

Tables 2-1 to 2-3 present the proportions in each category of social network participation by categories of work status transition for males. Participation in commitment and preference-based networks occurred more frequently than participation in prestige networks. Compared with wave 1, males who became new retirees at wave 2 showed an increase in the proportion that joined commitment and preference-based networks. We also performed a logistic regression that used male participation in networks at wave 2 as a target variable (Table 3-1). Retirement at wave 2, adjusting for age, education, marital status, working status at wave 1, and corresponding network participation at wave 1, was significantly associated with the likelihood of joining commitment and preference-based networks at wave 2 (odds ratio=2.14 for commitment network, odds ratio=3.02 for preference-based network). Tables 2-4 to 2-6 and Table 3-2 present the results of similar analyses for females. The proportions that joined network activities were generally lower among females compared with males. For females, retirement and homemaker status at wave 2 was not associated with the likelihood of joining social network activities of any kind at wave 2.

To summarize this section;

1. In males, transition from paid work to retirement was significantly associated with participation to social network outside of the workplace, while females did not show change in social network participation for neighborhood and personal activities in the process of work status transition.

III. Health outcomes, work status transitions, and social participation

III-1 Analytic model and data description

In this section, we will conduct the final stage of our analysis to reveal the health impact of work status transitions using wave 1 and wave 2 data derived from JSTAR. In the previous studies, there were used several strategies for the purpose. Dave, Rashad and Spasojevic (2006) relied on the fixed effects model to account for time-invariant unobserved heterogeneity in the use of panel data of Health and Retirement Study. They limited their participants to those without health conditions at the baseline, arguing that the sample selection as such would prevent reverse causation from health to retirement. However, they did not explicitly control for the retirement selection process in their model. Alternatively, Coe and Zammaro (2008) used the age of compulsory retirement across different countries participating in the Study of Health Ageing and Retirement in Europe as an exogenous instrument for retirement. However, physiological age is a strong predictor of various health conditions, and at least theoretically, the relevancy of the instrument is questionable. Another strategy was adopted by Behnck (2010) where propensity to predict the likelihood of retirement in the subsequent wave was matched. However, there remained possible misspecification due to unobserved confounders. To overcome pitfalls in the previous studies, we chose to adopt propensity-matching difference-in-difference approach to account for the likelihood of work status transition, while controlling for unobserved time-invariant confounders. Propensity to predict leaving the status of paid work at wave 2 was obtained by probit regression model regressing on demographic, economic, social, and health conditions at the time of wave 1 to prevent reverse causation from health to retirement, following Dave, Rashad, and Spasojevic (2006). Then the matched pairs of those actually left paid work status (treated) and those remained the status (control) were compared in terms of their health differential between wave 1 and wave 2.

In the JSTAR, we have a variety of health measures such as self-reported health status (SRH), instrumental activities of daily life (IADL), grip strength, psychological depression measured with the Center of Epidemiology Studies Depression scale (CESD), comorbidities (e.g. heart disease, stroke, cancer, etc.), and cognitive functions. SRH, IADL, and psychological depression are influenced not only by physical and mental health statuses but also by the degree of support from the surrounding environments. SRH and depression are further responsive to transient psychological stress by life events other than retirement, and more vulnerable to report bias. The features of these health measures are susceptible to unobserved and time-variant heterogeneity which may not be cancelled out by fixed effects modeling. Grip strength is the most objective measurement of physical health among available measurement in JSTAR, and is known to predict the prognosis of survivorship and functional independence. However, our preliminary analysis suggests that grip strength is a predictor of retirement decision rather than its consequence. Comorbidities of chronic conditions such as heart disease, stroke and cancer have been adopted as an outcome in previous studies. We chose not to use comorbidities because these conditions are more likely to be affected by life-course accumulation

of risk factors and availability of healthcare, rather than a tentative event of retirement. Finally, cognitive function is an important function affected by change in cognitive demand in daily lives as is discussed in Coe and Zammaro (2008). The function is also influenced by age-related diseases (e.g. Alzheimer disease) and one's educational achievement, of which impacts are rather time-invariant. We chose to use cognitive function as a targeted outcome in our analysis, following Coe and Zammaro (2008).

In JSTAR, HRS, and sister surveys, measurement of cognitive function includes orientation, numeric calculation, and word recall. Disorientation was quite rare among JSTAR respondents, and not suitable for our analytic purpose. Word recall measurement asks respondents to remember the names of 10 objects (nouns) in the presented cards, then to immediately recall as many as possible (Ofstedal, Fisher and Herzog, 2005). The count of correct answers ranges 0-10, reflecting short-term working memory and vocabulary abilities. We used word recall in our analysis.

We limited our sample to those aged less than 65, age younger than legal eligibility for public pension, and were engaged in paid work at the time of wave 1. The propensity of leaving paid work status at wave 2 was obtained separately for genders, since as we have confirmed in the previous sections, the pattern of status transitions were distinct by gender groups. The propensity was obtained by regressing on residential place, age, educational achievement, and economic, social, and health conditions at the time of wave 1. Economic factors included income and deposit. Social factors included respondent's participation to commitment and preference-based social network. Finally, health conditions included IADL limitation, grip strength, depression, current smoker status, and dummy codes for comorbidities (heart disease, hypertension, stroke, diabetes, cancer, cataracts, and arthritis). The calculation of propensity score was conducted using a built-in STATA 13 command of "pscore" with logistic regression and checking balanced distribution across included predictor variables. Then, kernel propensity matching was performed with "attk" command. Nearest neighborhood matching was conducted by "teffect nnm" command with bias correction adjustment for continuous variables. One-to-one propensity score matching with nearest neighbor was conducted with "teffects psmatch" command. All the procedures obtained Average Treatment Effect on the Treated (ATET) rather than Average Treatment Effect (ATE). Multiple imputation with chained equations was performed using "mi impute chained" command in STATA.

III-2 results

Tables 4-1 and 4-2 displays descriptive statistics of targeted sample who were aged at 65 years or younger at the time of wave1, and were engaged in paid work status, after multiple imputation

stratified by gender groups. Tables 5-1 and 5-2 show the results of logistic regression to predict propensity for leaving paid work status at the time of wave 2, regressed on respondent's characteristics at the time of wave 1. The prediction models for propensity scores showed significant likelihood ratio test statistics in males, but marginally significant in females. Pseudo-R-squares were around 0.11~ 0.13, suggesting that we may have misspecification to predict leaving paid work at wave 2 in our model.

Table 6-1 shows the estimation results of ATET using kernel matching, nearest neighborhood matching by Mahabinolous distance, and propensity score matching using the nearest neighborhood one-to-one matching, stratified by gender groups. To save overlapping assumption between treatment and control groups, the number of observations included in the analysis was smaller than the original number of samples. The estimated ATET was negative, suggesting that leaving paid work at wave 2 led to decline in cognitive function. The significance of estimation was varying according to matching algorithm. Results of one-to-one nearest propensity matching was significant, though we need some caution because the method has limitation in providing reliable estimation of standard errors. The lower rows of the table presents the results of ad-hoc stratified analysis by job characteristics. Those engaged in fulltime job, job with stress, and expectedly secured job showed a negative ATET estimation, while those engaged in non-fulltime status, job with less stress, and unsecured job exhibited null impact in cognitive function.
Table 6-2 shows the results for female sample. Except for nearest neighbor matching, the estimated ATET was close to zero. Even the nearest neighbor matching, the result was far from statistical significance.

IV. Discussion and Conclusion

Transition in work status in JSTAR participants was diverse and gradual. There were also striking gender differences in their trajectory path from labor participation to full retirement. For female respondents, becoming a homemaker was interchangeably used as an alternative to retirement. Thus, the results of treating "retirement" as a binary variable in the analytic model should be interpreted cautiously. In our analysis, we focused on "leaving paid work" as a transition event, which may indicate several attributes in one's later life. Leaving paid work may imply a loss of labor income, but is not necessarily accompanied by relief from social responsibility as a bread earner, or by a loss of social participation [Chaix, Isacsson, et al. 2007]. One may choose to shift from full-time to non-full time work status, taking into consideration loss of income against gain in leisure, health investment, family care, or simply availability of job opportunity. Leaving paid work status was related to the likelihood of participating in some type of social networks, though network participation at wave 1

was not a significant predictor of leaving paid work at wave 2, as our propensity score model showed. The association between work status transition and social network transition was not so remarkable for females.

The decline in cognitive function among male retirees who left paid work at wave 2 was in accord with what the role theory predicts. Those males who had been with full-time engagement in paid work may face a gap in social role when they loses their role as an employee, while non-full-time workers may have a gradual transition which allows them to better learn a new role in family and community. Females had a relatively narrower disparity in functions across work status transition. Many of females worked as a part-time basis, and their balance between roles as a worker and as a homemaker may allow female workers to obtain richer role repertoire that may make them proof against cognitive decline due to role transitions.

The results from JSTAR participants may provide important implications for health and labor policy in ageing society. Policies to ease role transitions may have a health impact to save cognitive function of the elderly. Skill training and career building in community and family during paid work engagement is already adopted in some companies as a preparation for the “second” life after retirement.

Finally, some caution is necessary. The measurement of word recall was unexpectedly improved between wave 1 and wave 2 despite of physiological ageing for 2 years, suggesting there worked learning effect in the measurement. In our analysis of difference-in-difference, we assumed that the learning effect occurred homogenously across the sample, though the assumption may not be valid. In the following waves, the word recall was limited to those aged over 65, and the latest wave in 2013 reopen the measurement for all age groups. Once the data become available, the finding in this study should be confirmed with extended measurement. We also have to admit that propensity-matching difference-in-difference approach we adopted may not treat well time-variant conditions, among which the most important will be the change in income. Shift from full-time work to full retirement will result in a larger change in income, compared to shift from part-time work. However, according to the permanent income theory, the household expenditure will not have such a big impact thanks to saving before retirement. Besides, in Japanese full-time workers, retirement will be accompanied by lump-sum retirement allowance, which also smooth the household expenditure level before/after retirement. Thus, we do not expect income change may alternatively explain cognitive decline more magnificent among full-time workers. However, the dynamic panel model with propensity adjustment may better treat the problem, which we should try when a larger number of waves of JSTAR data becomes available.

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Table 1-1; Trajectory of work status (all, both genders)

			Wave 2 status									
		N	full-time	part-time	self-employed	other employment	unemploy-ment	retired	home-maker	other status	lost to follow	total (%)
Wave 1	full-time	768	53.0	10.7	3.1	1.2	2.6	3.5	1.4	1.2	23.3	100
	part-time	669	5.4	55.5	2.4	1.8	2.2	5.1	4.0	1.4	22.3	100
	self-employed	529	3.4	3.6	60.1	2.5	0.4	4.5	1.3	2.1	22.1	100
	other employment	234	5.6	6.8	9.4	44.4	1.3	3.0	8.6	2.6	18.4	100
	unemployed	113	5.3	23.0	0.9	0.9	3.5	15.0	19.5	0.9	31.0	100
	retired	470	0.2	3.0	1.3	0.2	0.6	65.5	4.7	5.7	18.7	100
	homemaker	856	0.1	2.2	0.4	1.4	0.2	2.3	66.9	3.9	22.6	100
	other status	189	0.0	1.1	0.5	1.1	1.1	18.5	16.4	26.5	34.9	100

Table 1-2; Trajectory of work status (all male)

			Wave 2 status									
		N	full-time	part-time	self-employed	other employment	unemploy-ment	retired	home-maker	other status	lost to follow	total (%)
Wave 1	full-time	599	53.1	11.7	3.3	0.3	3.0	4.2	0.0	1.2	23.2	100
	part-time	290	7.6	52.1	4.5	1.4	2.1	10.0	0.7	1.7	20.0	100
	self-employed	443	4.1	3.6	61.6	1.1	0.5	5.0	0.2	2.3	21.7	100
	other employment	25	4.0	4.0	20.0	12.0	8.0	24.0	4.0	0.0	24.0	100
	unemployed	54	7.4	18.5	1.9	1.9	3.7	29.6	1.9	1.9	33.3	100
	retired	412	0.2	3.2	1.5	0.2	0.5	71.1	0.7	5.1	17.5	100
	homemaker	8	0.0	0.0	0.0	0.0	0.0	50.0	0.0	0.0	50.0	100
	other status	95	0.0	2.1	1.1	1.1	0.0	32.6	0.0	29.5	33.7	100

Table 1-3; Trajectory of work status (all female)

			Wave 2 status									
		N	full-time	part-time	self-employed	other employment	unemploy-ment	retired	home-maker	other status	lost to follow	total (%)
Wave 1	full-time	169	52.0	7.1	2.6	3.3	1.3	1.3	5.8	1.3	25.3	100
	part-time	378	4.2	59.0	1.0	1.6	2.6	0.7	6.5	1.0	23.5	100
	self-employed	86	0.0	1.7	62.7	5.1	0.0	1.7	5.1	1.7	22.0	100
	other employment	209	6.7	7.4	5.9	45.9	0.7	0.7	8.2	3.0	21.5	100
	unemployed	59	4.7	27.9	0.0	0.0	2.3	2.3	32.6	0.0	30.2	100
	retired	58	0.0	0.0	0.0	0.0	5.3	10.5	47.4	10.5	26.3	100
	homemaker	848	0.3	4.5	0.0	2.4	0.3	0.3	66.5	2.1	23.7	100
	other status	94	0.0	0.0	0.0	0.0	3.6	0.0	39.3	17.9	39.3	100

Table2-1; Participation in "commitment" social network by work status transitions; male

		full-time at wave2	part-time at wave2	self-employed at wave2	other employ-ment at wave2	un-employed at wave2	retired at wave2
full-time at wave1	N	284	65	15	2	17	23
	wave1	0.204	0.123	0.400	0.000	0.059	0.174
	wave2	0.243	0.292	0.333	0.000	0.294	0.435
part-time at wave1	N	21	134	12	4	6	26
	wave1	0.286	0.224	0.167	0.000	0.333	0.231
	wave2	0.333	0.269	0.333	0.000	0.500	0.385
self-employed at wave1	N	15	15	240	3	2	16
	wave1	0.067	0.400	0.283	0.667	0.000	0.250
	wave2	0.333	0.467	0.338	0.667	0.500	0.313
other employment at wave1	N	1	1	5	3	1	6
	wave1	0.000	0.000	0.200	0.000	0.000	0.333
	wave2	0.000	0.000	0.400	0.333	0.000	0.667

Table2-2; Participation in "prestige" social network by work status transitions; male

		full-time at wave2	part-time at wave2	self-employed at wave2	other employ-ment at wave2	un-employed at wave2	retired at wave2
full-time at wave1	N	284	65	15	2	17	23
	wave1	0.053	0.062	0.200	0.000	0.118	0.000
	wave2	0.063	0.062	0.200	0.000	0.059	0.087
part-time at wave1	N	21	134	12	4	6	26
	wave1	0.048	0.067	0.000	0.000	0.000	0.077
	wave2	0.143	0.037	0.000	0.000	0.000	0.038
self-employed at wave1	N	15	15	240	3	2	16
	wave1	0.000	0.200	0.104	0.000	0.000	0.125
	wave2	0.067	0.067	0.067	0.000	0.000	0.000
other employment at wave1	N	1	1	5	3	1	6
	wave1	0.000	0.000	0.000	0.333	0.000	0.167
	wave2	0.000	0.000	0.000	0.333	0.000	0.000

Table2-3; Participation in "preference-based" social network by work status transitions; male

		full-time at wave2	part-time at wave2	self-employed at wave2	other employ-ment at wave2	un-employed at wave2	retired at wave2
full-time at wave1	N	284	65	15	2	17	23
	wave1	0.243	0.231	0.400	0.000	0.235	0.304
	wave2	0.204	0.277	0.667	0.000	0.353	0.391
part-time at wave1	N	21	134	12	4	6	26
	wave1	0.238	0.261	0.167	0.000	0.167	0.154
	wave2	0.333	0.239	0.167	0.000	0.333	0.538
self-employed at wave1	N	15	15	240	3	2	16
	wave1	0.000	0.200	0.250	0.333	0.000	0.188
	wave2	0.133	0.200	0.233	0.333	0.500	0.188
other employment at wave1	N	1	1	5	3	1	6
	wave1	0.000	0.000	0.400	0.333	0.000	0.500
	wave2	1.000	0.000	0.200	0.333	0.000	0.500

Table2-4; Participation in "commitment" social network by work status transitions; female

		full-time at wave2	part-time at wave2	self-employed at wave2	other employ-ment at wave2	un-employed at wave2	retired at wave2	home-maker at wave 2
full-time at wave1	N	78	12	4	5	2	2	10
	wave1	0.128	0.083	0.000	0.000	0.000	0.000	0.200
	wave2	0.167	0.083	0.250	0.000	0.000	0.000	0.100
part-time at wave1	N	13	194	3	7	9	5	24
	wave1	0.077	0.216	0.333	0.000	0.000	0.000	0.124
	wave2	0.231	0.216	0.667	0.429	0.000	0.400	0.167
self-employed at wave1	N		3	40	7		1	4
	wave1		0.000	0.200	0.286		0.000	0.500
	wave2		0.333	0.175	0.143		0.000	0.500
other employment at wave1	N	12	14	16	89	1	1	18
	wave1	0.000	0.214	0.188	0.180	0.000	1.000	0.333
	wave2	0.083	0.214	0.250	0.157	0.000	1.000	0.556

Table2-5; Participation in "prestigeous" social network by work status transitions; female

		full-time at wave2	part-time at wave2	self-employed at wave2	other employ-ment at wave2	un-employed at wave2	retired at wave2	home-maker at wave 2
full-time at wave1	N	78	12	4	5	2	2	10
	wave1	0.038	0.083	0.000	0.000	0.000	0.000	0.000
	wave2	0.038	0.083	0.000	0.200	0.000	0.000	0.000
part-time at wave1	N	13	194	3	7	9	5	24
	wave1	0.077	0.072	0.333	0.143	0.222	0.400	0.000
	wave2	0.000	0.046	0.333	0.143	0.111	0.000	0.083
self-employed at wave1	N		3	40	7		1	4
	wave1		0.000	0.075	0.000		0.000	0.000
	wave2		0.000	0.025	0.000		0.000	0.000
other employment at wave1	N	12	14	16	89	1	1	18
	wave1	0.000	0.071	0.000	0.090	0.000	1.000	0.222
	wave2	0.000	0.071	0.000	0.056	0.000	1.000	0.111

Table2-6; Participation in "preference-based" social network by work status transitions; female

		full-time at wave2	part-time at wave2	self-employed at wave2	other employ-ment at wave2	un-employed at wave2	retired at wave2	home-maker at wave 2
full-time at wave1	N	78	12	4	5	2	2	10
	wave1	0.218	0.083	0.500	0.400	0.000	0.000	0.200
	wave2	0.244	0.333	0.750	0.000	0.000	0.000	0.400
part-time at wave1	N	13	194	3	7	9	5	24
	wave1	0.231	0.227	1.000	0.000	0.000	0.000	0.208
	wave2	0.308	0.278	1.000	0.143	0.222	0.200	0.208
self-employed at wave1	N		3	40	7		1	4
	wave1		0.333	0.350	0.143		0.000	0.250
	wave2		0.000	0.275	0.000		0.000	0.750
other employment at wave1	N	12	14	16	89	1	1	18
	wave1	0.500	0.357	0.375	0.180	0.000	1.000	0.444
	wave2	0.250	0.357	0.250	0.213	0.000	1.000	0.389

Tablel 3-1 Odds ratio for network participation at wave 2 by work status transitions; male

	commitment network participation at wave2	p-value	prestige network participation at wave 2	p-value	preference-based network participation at wave 2	p-value
age	0.985	0.313	1.018	0.537	1.020	0.206
education high	0.823	0.310	0.957	0.908	0.998	0.991
education college	1.011	0.972	0.807	0.711	1.157	0.653
education grad	0.961	0.862	0.766	0.576	1.178	0.502
never married	0.408	0.109	0.464	0.497	0.613	0.352
widowned	0.988	0.982	0.720	0.785	1.077	0.901
divorced	0.636	0.277	1.105	0.896	0.981	0.964
part-time wave2	1.293	0.319	0.546	0.255	1.242	0.429
self-employed wave 2	1.102	0.755	1.097	0.879	2.288	0.015
other employment wave 2	0.973	0.971	1.434	0.805	1.105	0.908
unemployed wave 2	1.922	0.150	0.402	0.422	2.498	0.050
retired wave 2	2.143	0.022	0.549	0.432	3.016	0.001
homemaker wave 2	1.687	0.683	NA		2.349	0.525
other wave 2	0.220	0.061	1.402	0.760	1.020	0.977
part-time wave 1	1.003	0.991	0.690	0.483	0.949	0.836
self-employed wave1	1.336	0.321	0.567	0.323	0.473	0.021
other employment wave 1	1.638	0.395	0.636	0.754	0.743	0.630
mobility limitation wave 2	1.179	0.575	0.133	0.058	0.639	0.204
ill health wave 2	1.114	0.491	1.141	0.672	0.954	0.781
N	933		930		933	
Pseud R2	0.090		0.195		0.099	

* adjusted for network participation as of wave 1

Tablel 3-2 Odds ratio for network participation at wave 2by work status transitions; female

	commitment network participation at wave2	p-value	prestige network participation at wave 2	p-value	preference-based network participation at wave 2	p-value
age	1.020	0.365	1.002	0.970	1.019	0.341
education high	1.748	0.059	0.662	0.480	1.309	0.315
education college	1.763	0.133	1.038	0.961	1.455	0.265
education grad	1.054	0.933	1.213	0.857	1.522	0.395
never married	2.012	0.156	0.342	0.400	1.246	0.641
widowned	1.579	0.196	0.689	0.604	1.005	0.988
divorced	0.635	0.448	NA		1.011	0.982
part-time wave2	0.690	0.407	1.891	0.513	1.528	0.281
self-employed wave 2	0.900	0.860	2.645	0.479	1.762	0.277
other employment wave 2	0.603	0.318	3.261	0.268	0.896	0.808
unemployed wave 2	NA		2.093	0.634	1.117	0.897
retired wave 2	2.117	0.392	2.983	0.493	1.320	0.758
homemaker wave 2	1.313	0.571	3.548	0.224	1.831	0.165
other wave 2	2.510	0.228	10.131	0.097	1.354	0.699
part-time wave 1	2.082	0.097	0.502	0.389	0.759	0.459
self-employed wave1	1.091	0.892	0.107	0.159	0.443	0.146
other employment wave 1	2.222	0.091	0.302	0.183	0.881	0.751
mobility limitation wave 2	0.647	0.269	1.523	0.546	0.672	0.272
ill health wave 2	1.148	0.558	1.067	0.895	0.838	0.409
N	564		542		576	
Pseud R2	0.1177		0.2958		0.0914	

* adjusted for network participation as of wave 1

Table 4-1 Descriptive statistics after multiple imputation (male<age 65, paid work at wave1)

	observation	mean	SD	range	
age	732	57.559	3.738	50	64
married	732	0.881	0.324	0	1
highschool graduate	731	0.420	0.494	0	1
college graduate	731	0.358	0.480	0	1
fulltime work at wave 1	732	0.561	0.497	0	1
secured job at wave 1	732	0.716	0.451	0	1
job with compulsory retirement	732	0.511	0.500	0	1
job with excess stress*	732	0.246	0.431	0	1
expecting public pension	713	0.820	0.384	0	1
treatment (leaving paid job at wave2)	732	0.078	0.268	0	1
smoker at wave1	731	0.435	0.496	0	1
poor self-rated health at wave1	730	0.441	0.497	0	1
IADL limitation at wave 1	732	0.398	0.490	0	1
ADL limitation at wave1	730	0.023	0.151	0	1
grip strength at wave 1 (Kg)	725	38.663	6.404	11	63
word recall counts at wave1	720	5.206	1.545	0	10
depression at wave1	732	0.145	0.352	0	1
heart disease at wave1	728	0.073	0.260	0	1
hypertention at wave1	728	0.265	0.442	0	1
diabetes at wave1	728	0.102	0.302	0	1
arthritis at wave1	728	0.018	0.133	0	1
cataracts at wave1	728	0.038	0.192	0	1
ln(income) at wave1	727	5.630	1.817	0	8.800
ln(deposit) at wave1	723	5.109	2.596	-3.363	11.768
stock/bond posession at wave1	725	0.207	0.405	0	1
social network (commitment) at wave1	731	0.209	0.407	0	1
social netwok (preference-based) at wave1	731	0.246	0.431	0	1

* (demand/control ratio>1.0)

Table 4-2 Descriptive statistics after multiple imputation (female<age 65, paid work at wave1)

	observation	mean	SD	range	
age	472	57.494	3.892	50	64
married	471	0.781	0.414	0	1
highschool graduate	469	0.516	0.500	0	1
college graduate	469	0.309	0.463	0	1
fulltime work at wave 1	472	0.239	0.427	0	1
secured job at wave 1	472	0.729	0.445	0	1
job with compulsory retirement	472	0.354	0.479	0	1
job with excess stress*	472	0.267	0.443	0	1
expecting public pension	467	0.869	0.337	0	1
treatment (leaving paid job at wave2)	472	0.133	0.340	0	1
smoker at wave1	472	0.153	0.360	0	1
poor self-rated health at wave1	472	0.392	0.489	0	1
IADL limitation at wave 1	472	0.269	0.444	0	1
grip strength at wave 1 (Kg)	471	24.338	4.409	8	37
word recall counts at wave1	468	5.711	1.503	2	10
depression at wave1	472	0.157	0.364	0	1
heart disease at wave1	471	0.040	0.197	0	1
hypertention at wave1	471	0.208	0.406	0	1
cancer at wave1	471	0.028	0.164	0	1
arthritis at wave1	471	0.053	0.224	0	1
cataracts at wave1	471	0.064	0.244	0	1
ln(income) at wave1	472	5.394	1.733	0	8.132
ln(deposit) at wave1	467	5.353	2.477	-2.974	11.919
stock/bond posession at wave1	469	0.228	0.420	0	1
social network (commitment) at wave1	472	0.174	0.379	0	1
social netwok (preference-based) at wave1	472	0.239	0.427	0	1

* (demand/control ratio>1.0)

Table 5-1 Propensity score for leaving paid work at wave2, by logistic regression (male)

	coefficient	std err	z	p
age	0.232	0.055	4.20	0.000
married	−0.786	0.433	−1.81	0.070
highschool graduate	0.112	0.399	0.28	0.778
college graduate	−0.066	0.471	−0.14	0.889
fulltime work at wave 1	0.443	0.371	1.20	0.232
secured job at wave 1	−0.737	0.317	−2.33	0.020
job with compulsory retirement	−0.043	0.391	−0.11	0.913
expecting public pension	0.184	0.352	0.52	0.601
job with excess stress*	−0.308	0.369	−0.84	0.404
smoker at wave1	−0.049	0.311	−0.16	0.875
IADL limitation at wave 1	0.062	0.323	0.19	0.848
grip strength at wave 1 (Kg)	−0.007	0.026	−0.26	0.791
word recall counts at wave1	−0.064	0.100	−0.64	0.522
depression at wave1	0.405	0.391	1.04	0.300
heart disease at wave1	−0.523	0.651	−0.80	0.422
hypertention at wave1	−0.118	0.341	−0.35	0.729
diabetes at wave1	0.338	0.448	0.75	0.451
arthritis at wave1	0.882	0.903	0.98	0.329
cataracts at wave1	1.208	0.599	2.02	0.044
ln(income) at wave1	0.210	0.133	1.58	0.115
ln(deposit) at wave1	−0.063	0.068	−0.92	0.359
stock/bond posession at wave1	−0.239	0.414	−0.58	0.564
social network (commitment) at wave1	−0.076	0.423	−0.18	0.857
social netwok (preference-based) at wave1	0.195	0.371	0.53	0.599
d_city3	0.277	0.451	0.61	0.540
d_city4	0.177	0.535	0.33	0.740
d_city5	−0.021	0.536	−0.04	0.968
d_city6	−0.539	0.581	−0.93	0.354
_cons	−15.708	3.831	−4.10	0.000

Number of obs = 712
LR chi2(28) = 52.44
Prob > chi2 = 0.0034
Log likelihood = −167.44037
Pseudo R2 = 0.1354

Table 5-2 Propensity score for leaving paid work at wave2, by logistic regression (female)

	coefficient	std err	z	p
age	0.167	0.047	3.58	0.000
married	-0.007	0.364	-0.02	0.984
highschool graduate	-0.358	0.406	-0.88	0.378
college graduate	0.113	0.459	0.25	0.805
fulltime work at wave 1	-0.052	0.415	-0.13	0.900
secured job at wave 1	-0.293	0.340	-0.86	0.390
job with compulsory retirement	0.417	0.357	1.17	0.243
expecting public pension	-0.058	0.441	-0.13	0.895
job with excess stress*	0.523	0.322	1.62	0.104
smoker at wave1	0.373	0.405	0.92	0.358
self reported poor health at wave1	0.130	0.321	0.40	0.687
IADL limitation at wave 1	0.117	0.347	0.34	0.735
grip strength at wave 1 (Kg)	0.026	0.038	0.70	0.485
word recall counts at wave1	0.036	0.104	0.35	0.728
depression at wave1	-0.084	0.439	-0.19	0.848
heart disease at wave1	0.422	0.722	0.59	0.559
hypertention at wave1	0.701	0.332	2.11	0.035
cancer at wave1	-0.891	1.131	-0.79	0.431
arthritis at wave1	-0.730	0.839	-0.87	0.384
cataracts at wave1	-1.848	1.088	-1.70	0.089
ln(income) at wave1	-0.236	0.096	-2.46	0.014
ln(deposit) at wave1	0.127	0.085	1.48	0.138
stock/bond posession at wave1	-0.309	0.428	-0.72	0.470
social network (commitment) at wave1	0.139	0.423	0.33	0.742
social netwok (preference-based) at wave1	-0.165	0.384	-0.43	0.668
d_city3	-0.251	0.456	-0.55	0.582
d_city4	-0.167	0.550	-0.30	0.762
d_city5	-0.169	0.513	-0.33	0.741
d_city6	-0.698	0.541	-1.29	0.197
_cons	-11.666	3.319	-3.51	0.000

Number of obs = 463
LR chi2(29) = 42.55
Prob > chi2 = 0.0500
Log likelihood = -159.1536
Pseudo R2 = 0.1179

Table 6-1 Estimated average treatment effect in the treated (ATET, leaving paid work at wave 2), male

	N	ATET	std error	t-stat	p-value
ATET by kernel matching	544	-0.238	0.234	-1.02	0.238
				z-stat	
ATET by neighborhood matching	497	-0.627	0.382	-1.64	0.101
ATET by PS matching	497	-0.432	0.152	-2.84	0.004

Psmatching adhoc stratified analysis

	N	ATET	std error	t-stat	p-value
full time	251	-0.421	0.246	-1.71	0.087
non-fulltime	218	0.167	0.600	0.28	0.781
stressed	97	-1.250	0.921	-1.36	0.175
less stressed	361	0.240	0.432	0.56	0.578
secured	355	-0.762	0.661	-1.15	0.249
less secured	137	0.063	0.451	0.14	0.890

Table 6-2 Estimated average treatment effect in the treated (ATET, leaving paid work at wave 2), female

	N	ATET	std error	t-stat	p-value
ATET by kernel matching	478	-0.023	0.303	-0.08	0.397
				z-stat	
ATET by neighborhood matching	365	-0.301	0.371	-0.81	0.287
ATET by PS matching	365	0.000	0.181	0.00	0.399