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ARE INDIVIDUALS WHO HAVE NON-WORK ACTIVITIES PRONE TO RETIRE EARLIER: EVIDENCE FROM TIME USE SURVEY OF OLDER FINNS*

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ABSTRACT: This paper examines how non-work activities affect retirement using Finnish time-use data for couples in 1999-2000 and follow up data on labour market status in 2000-2003. A market valuation of non-work time such as house work would incorporate the value of the increase in house work after retirement according to the household production model. We particularly examine house work as part of continuous time use activities and find that seven-hour increase in house work per week is associated with 12%-point increase in the probability to retire. Even though males do around one hour less house work per day than females throughout their different lifecycles, their retirement decision is most sensitive to the house work that they or their spouse supply. Postponed retirement of highly educated is also partly explained by them doing an average 6 hours per week less house work than others.

JEL-codes: J26, J14, J22

Keywords: Early retirement, Time use research, Leisure

1. Introduction

The motivation here is whether non-work time activities influence retirement patterns. The use of time-use data to model labour supply or retirement has been rather exiguous although the importance of time as a scarce resource in the economy has been approached theoretically since Becker (1965) and later by Juster and Stafford (1991). Mostly the focus has been on pecuniary incentives and demographic determinants, although family decision-making and care giving responsibilities are considered central (Lumsdaine and Mitchell, 1999). When time-use data have been used with respect to the perspective of the elderly, the purpose has only been to describe their time-use and not to study behavioral implications (See, for example Niemi and Pääkkönen, 1990, 2002, OECD, 2000, Gauthier and Smeeding, 2003). OECD (2000) examines patterns of work and leisure throughout the lifecycle of people. The study finds that an individual's latter years are associated with greater passivity, even at the age of 55-59 when health factors should not yet be a major problem. The results are, however, only indicative since individuals of the same age with or without jobs are not directly compared. Harmonized time use data in the area of European Union since 2000 and American Time Use Survey since 2003 have given an opportunity to examine, in an international comparable manner, how non-work time activities differ between workers and retired and how these are linked.

Piekkola and Leijola (2007) propose three ways how non-work time such as house work might affect retirement. Following the household production model by Gronau (1977), Graham and Green (1984) and Kerkhofs and Kooreman (2003), house work can be considered as 'work' that needs doing and men and women share these necessary chores. The value of house work can be merely measured by time spend on it. Piekkola and Leijola (2007)

evaluate the replacement rates and option values, including the value of house work, before and after retirement for three income-levels in 7 European countries. The housework is valued either by a wage on household help or by the minimum wage.[1] They show that the inclusion of house work in incentive calculations makes retirement more attractive, and that the results of the calculations correlate with the actual retirement ages in Europe. Replacement rates including the value of housework were on close average to 100% and explained well the retirement patterns.

Some house work can also be enjoyable as leisure – cooking, gardening and is comparable to active leisure. Time constraints can be more binding than when housework is a substitute for market work. In addition, it cannot be necessarily bought from the market. Finally, house work can provide structure and meaning to the day, a day that would otherwise be passive after one has retired. More house work hours when market work diminishes – sometimes rather mechanically – substitutes the foregone market work.

Here we evaluate the importance of pre-retirement time use under the assumption that this shows continuous time use patterns comparable to active leisure. We first broadly evaluate the substitutability between non-work time activities such as housework and active leisure to gain insight on the possible time constraints. We identify the determinants of early retirement in an empirical model that also includes monetary and demographic variables to examine how (i) option values generated through pension wealth and (ii) house work and preferences for different leisure time activities influence early retirement decisions. We apply instrumenting techniques to describe house work as part of life-time patterns, using time-use data gathered by Statistics Finland in 2000. We also analyse households in view of the findings in recent

[1] The replacement rate expresses as a percentage an individual's net pension that accrues from his net income from labour, corrected for the value of household work.

studies that male retirement decisions are most sensitive to the labour market decisions of their spouses (Coile 2004, Dahl et al., 2003, Johnson and Favreault, 2001) or to their own house work (Piekkola and Leijola, 2007). The study uses a binary probit model to explain the decision by aged workers to leave the labour market in 2000-2003, the subsequent period after the 1999-2000 time-use survey.

The section 2 describes the theoretical methodological background of the study. Section 3 presents some descriptive statistics of time use in Finland. Section 4 presents the results. The last section concludes.

2. Theoretical background

We first consider a simplistic model with weekly allocation of time to market work *E,* leisure *L* and house work *H*. Time use activities usually also include self-care *P* (sleeping). An individual's hourly net wages are w per week yielding weekly earnings wE. The level of earnings has an effect on pension wealth $PW_t \equiv PW(a, w_{a-1}E_{a-1})$, which is the level of the pension available at age *t* when retiring at age *a*, depending on net wages *w* and market work time *E* before retirement *a-1*. Pension wealth is the lump-sum equivalent of the total pension income a worker can expect to receive, taking into account pension level, retirement age and life expectancy. Time endowment is 168 hours per week, so that labour supply is $E \equiv 168 - L - H - P$.

Time-use patterns also depend on how constrained individuals are in their time use. Hamermesh (2005) indicates that individuals are highly time constrained as marginal hours of

market work substantially alter time-use patterns. Hamermesh argues that time-use constraints can be more binding for poorer families who cannot gain extra leisure time by purchasing household work from the market. Hurd (1996) argues that in the presence of labour market rigidities, work hours cannot be varied and the constraint will be to work more than an individual wants, or then not to work at all. Hamermesh emphasizes fixed costs from even a small amount of market work, stemming e.g. from the need to go to work. Time constraint is here defined as time away from other activities such as leisure (μ_L) or active leisure (μ_H) when one continues to work instead of retiring. Some of this may be explained by the need to carry out planned activities when retired already before. One may have to invest money and time in vacation home before retirement. Some house work such as investment in taking care of a garden also requires continuing upkeep.

The decision of the "bundle of goods" to be consumed then lays the frame for allocating time between work, leisure and the other main activity groups. For the consumers' utility (suppressing time indicator and ignoring time preference), and using budget constraint for composite good this gives (normalizing price of consumption good *x* to unity and abstracting from unearned income other than pension wealth)

$$V = U\left\{x[w(168 - L - H - P), PW(a, w_{a-1}E_{a-1})], L, H, P, \mu_L L, \mu_H H\right\}, \qquad (1)$$

where x= the quantity of goods consumed. From (1) the optimal allocation of time between leisure *L* and house work *H*, holding personal needs *P* and pension wealth *PW* as predetermined, are given by

$$V_L: -wU_x + U_L + \mu_L U_{\mu L} = 0\ ; \qquad (2)$$

$$V_H : -wU_x + U_H + \mu_H U_{\mu H} = 0 . \qquad (3)$$

The fixed costs in leisure or house work $\mu_L > 0$, $\mu_H > 0$ raise the opportunity cost of market work. The relative substitution and income effects of market wages are studied in greater detail in Piekkola and Leijola (2007). We can now analogously examine in three ways how house work and leisure influence retirement.

(i) House work and leisure are close substitutes $\mu_H \geq 0$

(ii) House work and market work are close substitutes $\mu_L \geq 0$

(iii) House work gives a meaning to the day $\mu_L = 0$

The first alternative explanation is the conventional model, where all non-market work time, such as leisure and house work, is qualitatively similar. Leisure and house work are necessarily close substitutes. Modification of this is to consider household work as valuable time similar to active leisure and not to entire leisure. Active leisure can include such activities as voluntary help, organizational activity, neighborly help, hobbies and sports. It is then possible that the house work is faced by time constraints $\mu_H \geq 0$, but not the total leisure time, which includes a lot of passive, less appealing elements. Since active leisure and household work are similar activities, after retirement an individual could also increase the time devoted to active leisure instead of household work. It would, therefore, be rather appropriate to give an economic value to the total household work and leisure, i.e. on the combined active non-work time before and after retirement (which we cannot do here).

The second approach is to implement the household production and to consider market work and house work as close substitutes. Therefore the only time constraint is the time for leisure

($\mu_L \geq 0$). In Gronau (1977) and Solberg and Wong (1991) household production function $Z(H, x_Z)$ combines auxiliary goods x_Z with home production time, which is considered as a substitute for consumption good. This gives

$$V = U\left\{x[w(168 - L - H - P) + Z(H, x_Z), PW(a, w_{a-1}E_{a-1})], L, P, \mu_L L\right\}. \quad (1')$$

Household good production rather than household work time enters the utility function, which as such implies that leisure time and household work time cannot be aggregated. It is easy to see from (1') that optimal household work supply is such that $\partial Z / \partial H = \partial Z / \partial x_Z w$, where $\partial Z / \partial x_Z = 1$. Household work time should be dependent on the return to market work *w* only, and not on the allocation of time to other activities. Specialization by genders mitigates time use constraints when one can "buy" extra time by purchasing the house work from the market or from the spouse. Graham and Green (1984) and Kerkhofs and Kooreman (2003) further include additively separable direct utility from house work such as $g(H)$, $g'(H) \leq 1$, which modifies the optimal marginal productivity of household work to $\partial Z / \partial H = w(1 - g'(H))$. We then have a model which includes elements of first approach, too.

The third alternative is that extra house work is done in response to diminishing working time. House work at the retirement age provides meaning to the day, but marginal value of it can be low $\partial V / \partial H \approx 0$. We can consider the current house work to even lessen the opportunities to replace market work by house work. The more an individual is already involved in house work when employed, the fewer the opportunities for house work are after retirement. It is also unlikely that one faces time use constraints in leisure time opportunities, $\mu_L = 0$.

We analyse non-work time use to receive information on which of these hypotheses hold. Retirement patterns are viewed under the first hypothesis, where non-work activities before

retirement may indicate life style patterns that are of importance in withdrawal from work. Instrument techniques are used to explain house work according to factors which we assume not to be time constrained, thus reflecting a preference for house work over an individual's lifetime as well as shifting towards it after retirement. Pecuniary incentives are examined following Stock and Wise (1990). We report the incentives to stop working during the current year relative to retiring at some future optimal age. The effects of changes in wages and other income available are vetted using the option value approach. For each retirement age, the *option value* (OV) expresses the trade-off between retiring immediately and keeping the option open to retire at a later age. Let $V_s(a)$ refer to the expected discounted future utility at age t if the worker retires at age a specified as (see Stock and Wise, 1990, Coile and Gruber, 2000):

$$V_s(a) = \sum_{t=s}^{a-1} \left[w_t \right]^{\gamma} (1+\delta-z)^{-(t-s)} + \sum_{t=a}^{T} \left[\alpha \, PW_t(a, w_{a-1}) \right]^{\gamma} (1+\delta)^{-(t-s)}, \qquad (4)$$

where T = the expected age of death at each age t by gender, s = the current period, a = the period of retirement, δ = the real discount factor 6%, z = annual wage growth 1%, w_t = the wage income at age t, $PW_t(a,w_{a-1})$ = the level of pension available at age t when retiring at age a, depending on earlier wages; α = the relative utility of the pension benefits to the wages or the marginal utility of leisure; γ = the utility curvature parameter or the risk aversion parameter.

The utility of consumption is represented by an isoelastic utility function, $U(w)=w^{\gamma}$ and $U(PW)=[\alpha PW]^{\gamma}$. The utility parameters and discount rate are based on Coile (2004). The utility function parameter γ takes the value of 0.75. To capture utility from extra non-work time after retirement, the utility during retirement is weighted by $\alpha>1$, which is set at 1.5 ($1/\alpha$ is the marginal disutility of work). The incentive effects of option value on retirement is

robust when we use alternative values for the marginal utility of leisure parameter α and the discount rate δ.

The option value for a specific age is defined as the difference between the expected lifetime utility if the individual postpones his decision until the optimal retirement age (which is not necessarily next year) and the expected value if he retires immediately. If the individual retires immediately, he loses a number of years of income and the higher pension benefits. But if he retires later, he will lose the forgone leisure time. The option value, giving the opportunity cost of retiring today, is

$$OV(a) = E_s\left[V(a)\right] - V_s(s), \tag{5}$$

where E= the expectation operator. Option values are strongly dependent on age because pension wealth accrual is linked to life expectancy. The optimal retirement a^* should occur at an age when the option value becomes negative. A higher option value provides the incentive to stay at work longer.

Appendix shows how the pension level and thereby pension wealth is linked to pensionable salary, work experience and the regulations on early retirement. In the pension system effective until 2005 the pensionable salary is the gross income net of the employee's pension contributions and corresponds to the average salary of the last 10 years (here we have information only on earnings at the time of survey).[2] Work experience determines the accrual of pension rights and is here assessed by age minus the number of years in school, with pre-

[2] In a new system effective in 2005 pension accumulation is related to all earned salaries during one's entire work history, unemployment pension is substituted by continued unemployment pension pipeline after 60 years and additional incentives are introduced to postpone retirement after 62 years of age. The major change in early retirement is the restrictions made on part-time retirement and the abolishment of individual early retirement.

school years included. The option values from (4) and (5) are calculated based on the assumption that a retired individual is on a disability pension if aged below 57 years, and in the unemployment pension pipeline if aged between 57-64 years of age (unemployment pension not an option below this age). This assumption is possible, as the pension levels are roughly similar for the disability and unemployment pension pipeline schemes and unemployment pension pipeline is an average slightly preferable to old-age pension at age below 65 years (see Appendix A).

3. Time Use of Finns

Time-use variables listed in previous chapter are from harmonized time use survey envisaged by Eurostat, which was first conducted in Finland. Statistics Finland asked people to maintain a diary to record track of their daily activities in 2000 (from March 1999 to March 2000). The respondents recorded their activities for two randomly selected days, 10, 561 in total, one of which was a weekday and the other weekend day. Recordkeeping was done without any pre-coded selection of activities. Daily activities were described by the respondents in their own words and coded according to the 185 different activities classified by Statistics Finland in 2002. Time use reported here is based on the averages of the weekday and weekend measured as hours per week. Here the time-use and work status variables are the following using Finnish time use survey 1999-2000.

Work. Paid work including overtime work, paid work done at home, coffee breaks and lunch hours.

Working (Employed). Employment status is based on the self-reported situation at the survey time. The employed category may include some respondents who were in the work life, but did not work either due to illness or vacation during the survey week.

House work. Every kind of activity conducted for the benefit of the household. Includes child care, food preparation, cleaning, laundering, renovation, gardening, shopping, fixing car. This excludes neighborly help or caring for relatives other than one's own family.

Leisure. This includes voluntary work, neighborly help, hobbies, sports, socializing, traveling. This is residual time over that spent on personal needs, work, house work and also excludes here traveling (except traveling as main activity).

Neighbor help. Unpaid work outside home, which includes the help of relatives.

Active Time. The sum of work, house work and leisure.

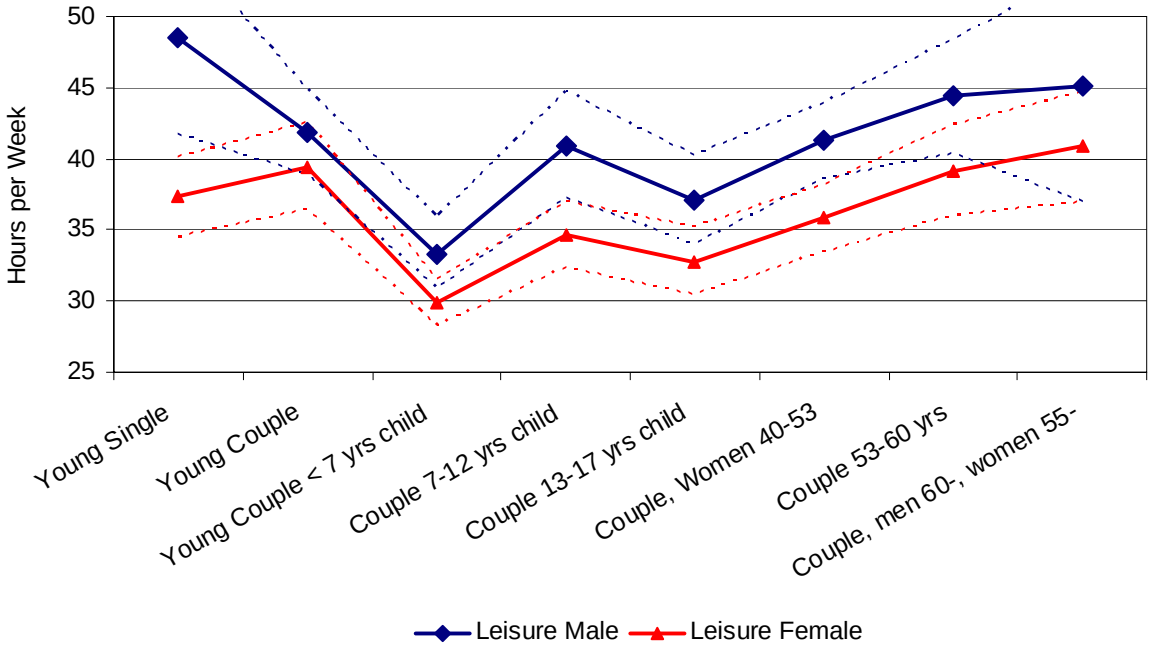
Sport / Leisure. Sport as share of leisure.

Primary- and secondary activity. Respondents can also report secondary activity, which are here analyzed in main categories of house work and leisure.

The following figures show time use over life cycle of individuals in the work age 18 – 75 excluding retired and students and assuming two-adult household except in the first life phase (2006 observations in total).[3] The figure 1 shows the leisure time of males and females over their working age lifecycles (dash lines show 95% confidence intervals).

[3] Of the 4,250 individuals of age 18-74 we exclude observations for other adults than for spouses or being the single adult (338 obs), unreliable income data (220 obs), and time use in personal needs or household work (25 obs). After these corrections time use of the adult family member in the four main time use categories we eliminate 25 outliers in multivariate data using the method of Hadi (1992, 1993) with education, gender and age as controls. We also exclude students (356 observations), those doing secondary work (199 observations) and retired (330 observations) and individuals not belonging to any of the life phases (396 obs).

Figure 1. Leisure over Working Age Lifecycle (excludes retired)

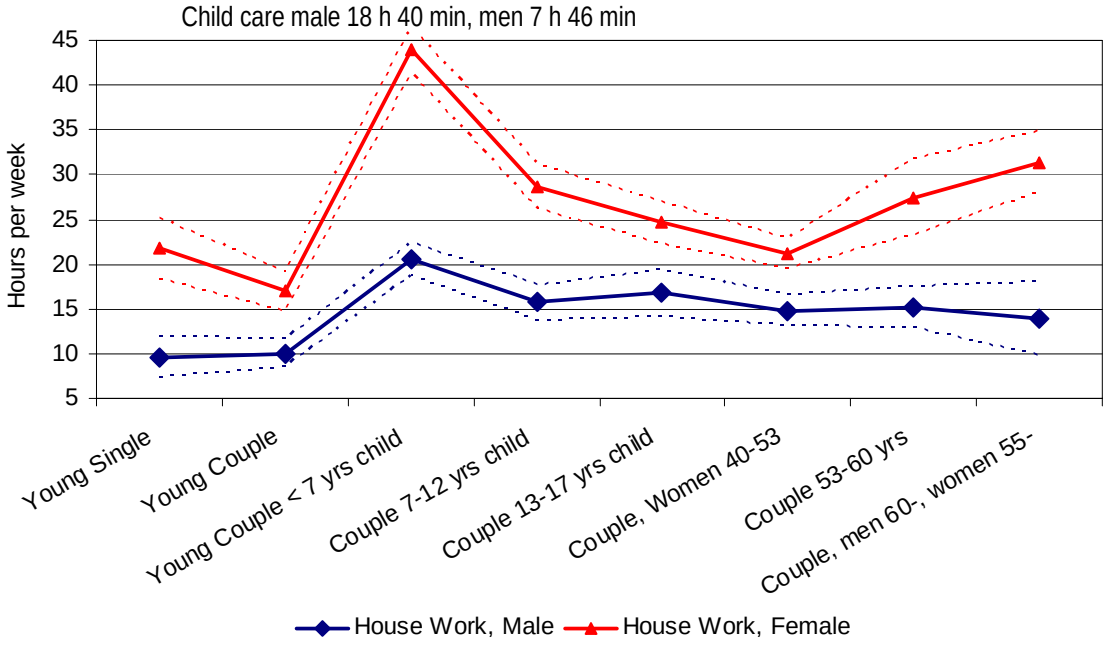


As can be seen, men have some 5 hours per week more leisure throughout the various cycles of their lives, and the difference does not diminish even when both spouses, for the most part, are retired, as in the case of the oldest couples. The increase in leisure time starting at 40-45 years is very similar for both genders. The oldest couple spent some 8 hours more in leisure than those 40-45 years of age. The following figure shows the changes in paid work of employed and house work of all during the lifecycle of men and women.

It is seen from figure 2 that for men length of the working week decreases only little over the lifecycle as long as one is working. The typical work week for women spouse instead decreases to 24 hours for couples 53-60 years of age and to 15 hours for the 65-year olds among those who are still employed. The weekly peak hours in house work are explained by childcare responsibilities when the youngest child is less than 7 years old.

Figure 2. Work of Employed over Lifecycle

Figure 3. House Work over Working Age Lifecycle (excludes retired)



It can be seen that for the oldest couple for those still not retired, the house work of men does not rise, whereas that of women increases substantially by more than 10 hours, compared to the middle-aged at 40-53 years. The increase in house work is clearly away from paid work so

that the total work time does not increase correspondingly. This hints that part of extra house work is rather mechanically done in response to diminishing working time following hypothesis 3. The greater increase in house work for women is seen later to have little relevance on the retirement decision. Furthermore, Piekkola and Leijola (2007) also find the increase in house work to be at least of similar magnitude for men than for women for retired compared with non-retired at the age of 50 – 64 years in 7 European countries considered.

4. Estimation results

We limit our analysis to spouses, thus excluding single-adult households. The data cover 66% of individuals in the age bracket 53-64 years. Among the 53-59 year old individuals, the highly educated workers with tertiary education have a high employment rate 85%, which exceeds the 56% rate for individuals with less than higher tertiary education. Table 1 shows the summary figures of the variables in the age group 53 – 64 years for employed individuals, excluding again single adult households. When there is a difference in the time use, the figures for the employed are given separately by gender and education level.

It is noted that the option values measured in utility units are close to zero with the selected high discount rate of 6%, thus well highlighting the desire for early retirement at these ages. As can be seen, the highly educated have higher option values and less financial incentives to retire. This is explained by higher income in comparison to the value of post-retirement leisure. House work is less common for males, particularly so for the highly educated. Hobbies and sports are measured as a share of leisure. Hobbies as a share of leisure account for a fairly low share of total leisure time 2-3%. This, together with the 4% share of leisure time for sports, represents here alternative forms of active leisure. House work combining

leisure as a secondary activity accounts nearly one hour of the total house work and is more typical for women.

Table 1. Summary Employed with Spouse, Aged 53-64 years

Variable	Education Level	Mean	Std. Err.	95% Confidence Interval	
Option Value Employed	Other (124 obs)	0.09	0.004	0.08	0.10
	Higher Tertiary (28 obs)	0.18	0.013	0.15	0.20
House Work / Total Work		0.44	0.030	0.39	0.50
House Work, Male	Other	17.3	2.2	13.1	21.5
	Higher Tertiary	11.6	3.2	5.3	17.9
House Work, Female	Other	25.5	1.8	22.0	29.1
	Higher Tertiary	19.8	4.5	10.9	28.7
	Gender				
Leisure	Male (76 obs)	40.3	1.95	36.49	44.15
	Female (76 obs)	37.9	1.50	34.95	40.84
Sport / Leisure %	Male	4 %	0.75 %	2.6 %	5.5 %
	Female	4 %	0.53 %	3.3 %	5.4 %
House Work with Leisure	Male	0.6	0.21	0.19	1.01
as Secondary Activity	Female	1.0	0.19	0.60	1.34
Neighborly help 1-15h	Male	16 %	4.37 %	7.0 %	24.2 %
or Voluntary Help 1-14h %	Female	23 %	5.23 %	12.4 %	33.0 %
Neighborly help > 15h	Male	13 %	3.84 %	5.0 %	20.1 %
or Voluntary Help > 14h %	Female	16 %	4.62 %	6.7 %	24.9 %
Hobby / Leisure %	Male	3 %	0.67 %	1.2 %	3.8 %
	Female	2 %	0.45 %	1.0 %	2.7 %
Busy Sometimes %	Male	64 %	6.04 %	52.2 %	76.0 %
	Female	57 %	6.20 %	45.3 %	69.7 %
Busy Continuously %	Male	7 %	2.86 %	1.7 %	12.9 %
	Female	22 %	4.94 %	11.9 %	31.4 %

Table shows weekly time use or share involved in an activity or being busy. Option value is measured in utility. Other refers to other than higher tertiary education (university level).

House work as a substitute for market work or leisure

We first examine house work according to individual and time use patterns. This is done in order to see whether the traditional model of considering house work production as a pure substitute for market good holds. We also evaluate house work with leisure as a secondary activity. We expect house work that enables simultaneous leisure activity to be a substitute for leisure rather than for market work. This can be more constant throughout one's lifetime and

can be used as one instrument when explaining retirement behavior. House work combined with leisure is estimated with a two-part model that takes into account the large number of zero observations. The two-part analysis by Manning *et al.* (1987) is appropriate when errors violate normality in two ways. First, there is significant censoring with a large share of house work having zero leisure. Second, house work with leisure as a secondary activity exhibits high skewness and has heavier than normal tails (here skewness is 1.6 and kurtosis is 5.1). We first run probit estimation for the entire sample (individually for the employed and the non-employed). We then generate predicted values for the probability of having house work with leisure and multiply this by the conditional expected value. We use this in OLS estimation as an auxiliary explanatory variable on the subsample of those with some house work with leisure as a secondary activity.

Table 2 gives the coefficients and marginal effects of the variables at a sample mean for dummy variables. In all the reported results, standard errors are sample weighted and corrected for strata and cluster sampling.

Our model in column 1 explains 37% of the variation in the house work of employed workers, which is comparable to Graham and Green (1984). It can be seen from column 1 that weekly house work for females is significantly higher than for males, with a difference of 7.9 hours. The differences are close the same as without any controls (see table 1). Women active in neighborly help and sports appears to do more house work, while these activities have much less clear relation to house work for men. Some mutual sharing of house work is noted from the 2-hour decrease in housework if an individual's spouse is non-employed in column 1. A spouse being busy with house work does not, however, appear to reduce one's own house work.

Table 2. House Work and House Work with Leisure (Two-Part Estimation) of Employed

Dependent Variable	1	2	3	4a	4b
	House Work			House Work with Leisure as Secondary Activity	
	All	Women	Men		
Variable		OLS		OLS	Probit for any
Net Earnings	-4.15	-14.08**	2.06	0.51	-0.11
	(1.5)	(3.1)	(0.4)	(0.9)	(1.1)
Female d	7.93**			-0.80+	0.35**
	(2.7)			(1.7)	(3.3)
Higher Tertiary d	-4.53	0.22	-2.67	-1.52**	0.14
	(1.4)	(0.1)	(0.6)	(2.9)	(0.9)
Personal Needs with Leisure as Secondary Activity					0.53**
					(3.3)
Leisure with No Secondary Activity					-0.11**
					(3.1)
Neighborly help 1-15h or Voluntary Help 1-14h	-1.42	-2.01	-1.75	1.58**	-0.06
	(0.5)	(0.5)	(0.4)	(2.8)	(0.4)
Neighborly help > 15h or Voluntary Help > 14h	4.60	9.34+	-0.05	0.79	-0.20
	(1.4)	(1.8)	(0)	(1.6)	(1.5)
Hobby / Leisure	36.07+	34.84	14.65	0.02	1.24
	(1.7)	(1.5)	(0.5)	(0)	(1.1)
Sport / Leisure	-10.10	57.09*	-33.74	11.78*	1.83
	(0.5)	(2)	(1.3)	(2.6)	(1.6)
Busy Sometimes d	7.56*	9.82*	2.54	0.68	0.36**
	(2.5)	(2.4)	(0.9)	(1.2)	(2.9)
Busy Continuously d	5.15	7.19	-6.38	-0.71	0.11
	(1.4)	(1.4)	(1.1)	(1.4)	(0.5)
Spouse's Household Work	0.20	0.21*	0.20	0.00	0.00
	(1.6)	(2.3)	(1.7)	(0)	(0.4)
Spouse Non-Employed d	-2.35	-4.09	1.02	1.61**	-0.13
	(0.7)	(1.2)	(0.2)	(3.1)	(1)
Municipal Size 100000 > d	-2.39	-0.27	-2.65	0.74	-0.38**
	(1)	(0.1)	(0.6)	(1.3)	(3.2)
Probability House Work with Leisure				0.91***	
				(3.9)	
Observations	126	67	59	60	126
R-squared	0.37	0.48	0.47	0.56	
F statistics	3.07	4.46	3.50	9.7	1.61
Predicted right%					77.0 %

Note. Marginal effects are reported for dummy variables. All estimations have as explanatory variables age, age squared, two education dummies, family help dummy, two additional region size dummies. Net earnings in thousand euros. (d) marginals for discrete change of dummy variable from 0 to 1, * p<0.05, ** p<0.01, ***

We can see that the traditional model of considering house work production as a pure substitute for market good does not hold, at least entirely. Similar to Solberg's and Wong's (1991) empirical analysis, we can observe a violation of the second hypothesis that house work is a substitute for market work for men. Net earnings are scant explanations for house work of men in column 3. However, net earnings from market work are negatively related to

house work for women in column 2. Therefore pecuniary incentives can be important in the house work supply decision of women. It is also noted that a busy active life has a clear positive effect on the house work of the employed women. However, it is later seen that this busy life does not drive women to retirement.

Overall, it is seen in table 2 that house work of women also relates to many active leisure activities such as neighborly or voluntary help, hobbies and sports. We find it important to instrument house work of women in order to capture the continuous activities that are more clearly related to leisure activities. In this way we are able to exclude the house work activities of women that appeared in figures 2 and 3 only to reflect the decrease in the supply of paid work over life cycle. The two-part model for the supply of house work with leisure as secondary activity (columns 4a and 4b) first evaluates the probability of combining any house work with leisure in column 4b, as explained before. The marginal effects from the probit estimation are reported. In comparison to males, females have 35% greater likelihood of combining house work with leisure. Passive individuals who spend considerable leisure periods with no secondary activity are less likely to do house work in conjunction with leisure. Those people who combine personal needs with leisure are instead more likely to also combine home work with leisure. The determinants for those who spend time on house work with leisure, nearly half of all, are reported in column 4a. The auxiliary variable probability time s conditional predicted value is significant. As expected, house work with leisure is linked to such active leisure as neighborly/voluntary help and sports, thus appearing to be a complement to active leisure.

Non-work time activities and retirement

We examine the withdrawal from work in the subsequent years 2001-2003 after the 1999-2000 survey. Detailed information on the respondents' labour market status at the end of the survey year as well as on earnings in 2001-2003 is from register data of Statistics Finland. Dummies for the withdrawal from the labour market receive the value of one if the individual is retired or has taken early retirement, if the individual is permanently unemployed (thus within the unemployment pension pipeline) or if the individual received no salary income during the whole year. We include in the analysis all employed spouses based on self-report at the time of survey who are at age 53-64 (152 observations). We consider him/her retired in years 2001-2003 (98 observations out of 152 or 65%) using information on the register data if

1) Retired in old-age or annual earnings (excluding any pension income) are below median incomes, in 2001 thus below 21,300 (29% of observations).
2) Unemployed and then retired or directly in unemployment pension (13% of observations).
3) Enters disability pension, individual early retirement (includes health evaluation) or part-time pension (23% of observations).

We have explained the pension system and early retirement routes in greater detail in appendix. 29% of individuals had retired on old-age pensions, which is possible in many occupations before the age of 65 (official retirement age in the public sector was 63). Early retirement on the basis of the disability or part-time pension (23%) and unemployment pension route (13%) are important retirement options, particularly for workers other than the highly educated. The shares are consistent with disability or unemployment pension receivers being about 60 per cent of the age group 60-64 in the period during which the time use survey was made in 1999-2000. We also consider separately those who have postponed retirement into 2003 and not earlier (19 observations).

Table 3. Work Withdrawal during 2000-2003 for older workers who had been employed in 1999.

	1	2	3	4	5	6	7	8
		Probit			IV Logit	Multinomial Logit		
Variable		Retirement 2003	Interactions	No Old-Age Pension		Old-Age Pension	Unemployment Pension	Other Early Retirement
Option Value	-2.746***	0.556+	-2.844***	-0.034	-4.057***	-4.935**	-0.005+	1.7
	(3.545)	(1.803)	(3.913)	(0.032)	(3.914)	(2.5)	(1.91)	(0.82)
Log Unearned Income (Household)	-0.017*	-0.004	-0.012	-0.020	-0.031*	-0.022	0.000	-0.002
	(2.119)	(0.863)	(1.555)	(1.632)	(2.137)	(1.059)	(0.89)	(0.13)
Female (d)	0.063	0.024	0.171	-0.211	0.026	0.229	0.000	0.019
	(0.858)	(0.917)	(1.2889	(0.903)	(0.239)	(1.25)	(1.01)	(0.08)
Higher Tertiary (d)	0.132**	-0.050	0.129**	0.004	0.325***	0.584***	0.000	-0.38***
	(3.036)	(1.583)	(3.305)	(0.038)	(3.729)	(5.09)	(0.08)	(3.9)
House Work / Total Work	0.148+	-0.094**			0.724*	-0.249	0.000	0.454*
	(1.894)	(2.789)			(2.398)	(1.17)	(1.15)	(2.06)
House Work / Total Work, Female			0.022	0.459*				
			(0.184)	(2.573)				
House Work / Total Work, Male			0.291**	0.518*				
			(2.877)	(2.151)				
Busy Sometimes (d)	-0.197**	-0.020	-0.161*	-0.060	-0.317**	0.584***	0.000	-0.38***
	(2.716)	(0.610)	(2.297)	(0.567)	(2.986)	(0.95)	(0.39)	(2.79)
Busy Continuously (d)	-0.213	-0.032	-0.205	0.072	-0.306+	-0.022	0.000	-0.186
	(1.439)	(1.317)	(1.541)	(0.434)	(1.751)	(0.11)	(0.83)	(1.36)
Spouse Retired (d)	-0.043	0.023			-0.139			
	(0.634)	(0.951)			(1.215)			
Spouse Retired, Female (d)			0.110	0.027				
			(1.371)	(0.215)				
Spouse Retired, Male (d)			-0.346*	-0.265*				
			(2.116)	(2.580)				
Spouse's House Work	0.003	0.000			0.005			
	(1.555)	(0.352)			(1.466)			
Spouse Household Work, Female			0.002	0.001		0.003	0.000	-0.003
			(0.511)	(0.35)		(0.72)	(0.03)	(0.62)
Spouse Household Work, Male			0.007*	0.005		-0.002	0.000	0.009*
			(2.271)	(1.56)		(0.66)	(1.09)	(2.08)
Spouse's Hobbies	-0.652	-0.207	-0.830	-2.169+	-1.269+	1.910	0.000	-3.323
	(1.333)	(0.818)	(1.573)	(1.806)	(1.749)	(1.2)	(0.01)	(1.47)
Observations	145	145	145	145	145	145	145	145
F Statistics / Instrument Validity p-value	2.410	1.850	2.350	1.540	0.046			
Correctly specified (cut point >=0.5)	87.4 %	17.4 %	84.8 %	41.5 %	69.3 %			

Note. Marginal effects are reported. Dummy variables are indicated by d. All estimations have part-time employment, three region size and survey season dummies. In column 5 house work is instrumented by house work in the respective group in 1987, house work with leisure secondary activity, survey day monday or friday. Other early retirement pension include disability pension, individual early retirement, part-time pension. z statistics in brackets +Significant at 90% confidence level, *Significant at 95% confidence level, ** Significant at 99% confidence level.

The estimation is based on probit and multinomial logit estimates in survey models. In the multinomial logit analysis we consider the three retired groups separately using those still employed in 2003 as the reference. We do not use other individual's time use variables except home work to explain retirement. Additionally, we use instrumenting techniques to explain house work as share of total work (paid work + house work) according to factors which we assume not to be time constrained, thus reflecting a preference for house work over an individual's lifetime as well as shifting towards it after retirement. The instrumental variable estimations are calculated without adjustment for clustering or sample weights.

Our first instrument is house work with leisure as secondary activity. In table 2 this appears to complement active leisure time use, and particularly so for women. The house work with leisure as secondary activity is positively correlated with the house work as share of total work (0.56), while is fairly unrelated to the employment status (0.12). Our second instrument is the share of home work compared to total work as given in the 1989 time-use survey. This projects the average house work over the lifecycle of the age, gender, education and socioeconomic group to which the individual belongs and is independent of his/her labour market status. The group categories include, besides gender, five-year age group, blue-collar workers, elementary schooling, also median income decile and marital status, yielding a total of 160 groups. All individuals are accounted for in 55 groups (no observations in the remainder 105 groups). This has a correlation of 0.21 to house work share in 1999-00 time-use survey, while a correlation of 0.12 to retirement status.

We also use Monday and Friday dummies that somewhat improved the validity of the instruments. Individuals to whom the workweek time use report was made for Monday or Friday do on average 4 hours more house work during the whole week compared to those to whom workweek time use was reported from Tuesday to Thursday. The working hours are shortest just

before weekend on Friday and after weekend on Monday. This allows individuals to spend time on the home work and also larger share of this is done with leisure as secondary activity.

The following table shows the estimation results. Column 5 shows the instrumental variable estimation and last three columns 6-8 multinomial logit results. In all estimations, marginal effects are reported. The instrument estimation passes the instrument validity test by Smith and Blundell (1986) at 5% level. This test is related to the Davidson-MacKinnon (1993) auxiliary regression test, where the predicted values for the endogenous variables are first estimated using the instruments and control variables. At the second stage, the predicted values together with original values are used in the same regression. Instruments are valid if the predicted values are of significance.

Prediction success can be measured with an index of correct predictions. This is rather high, 84.8%-87.4% in columns 1 and 3 and 69.3% in instrument estimation in column 5. It is seen that the model would work poorly without old-age pension route in column 4 as prediction success falls to 41.5% (the reference here is those still employed in 2003 or in old-age pension).

As can be seen, pecuniary incentives have the right sign, since those with lowest option values are the first to retire. Option value also captures the value of leisure time when retired and varies by age (because of which age variables are dropped). The positive effect of a household's unearned income on early retirement is also as expected, but is insignificant. This weakly supports the theory according to which wealth increases an individual's consumption possibilities and thus lowers the need for labour-market wages (for similar results see Perachhi and Welch, 1994, and Dahl et al., 2000).[4] The coefficient for part-time work is not statistically

[4] Note also that in the data, the average unearned income of women exceeds that of men irrespective of labour market position.

significant (included in the estimates but not reported). Existing part-time work arrangements do not appear to "constitute a bridge" between full-time work and full retirement.

It is seen that the share of house work compared to total work enhances the early retirement probability for males (column 3), for all in the instrument estimation (column 5) and in the withdrawal to other early retirement schemes (column 8). The instrument estimation in column 5 gives the strongest positive effect on the probability to retire. A seven-hour increase in house work per week (home work as share of total work increase from 44% to 60%) is associated with 12%-point increase in the probability to retire. Last columns 8 reveals that the house work effect is especially related to early retirement. Column 2 analogously shows that house work does enhance postponed retirement in 2003, but withdrawal from work at earlier period in 2001-2002. In column 3 we analyse house work and spouse's house work according to gender. This shows evidence that men's work withdrawal is clearly related on their share of house work as well as to the wife's house work. On the part of females, instead, their own house work burden or that of their husbands has no implications on retirement. This is what we expected without instrumenting as major part of the house work closely attaches with market work and pecuniary incentives, which are here separately analyzed. After instrumenting the explained house work captures better continuous time use activities and do explain early retirement.

We conclude the following on the part of female and male house work. Males do house work activity that is less related to pecuniary incentives and in retirement men also take part of wife's duties, especially if wife is not retired. We find asymmetric substitutability of house work rather than husband's enjoyment of retirement depending on the wife being retired as suggested by Coile (2004): husband may substitute house work of wife but not the other way around. One more hour of wife's house work increases the probability to retire by 7%. This

also differs from Clark et al. (1980), Coile and Gruber (2001), Dahl et al., (2003) and Johnson and Favreault (2001) who all find that the spouse's participation in the labour market diminishes the motivation to withdrawal and especially so for men. It is seen from column 3 that if the wife is retired, the probability that the husband retires instead decreases by 34.6%. Thus there is motivation for retirement if the wife is engaged in house work while in working life but not if women is retired. To obtain further confirmation of the importance of the spouse's non-work time use, we have also included the spouse's hobbies in the analysis. Although the variable is significant only at 10% level, it always has a negative sign indicating that spouse active in hobbies diminishes one's own retirement propensity.

On the other hand, if men are heavily engaged in house work, this is of different kind that cannot be expected to be carried out by women spouse. We also observe large relative changes in house work for men whey they turn non-employed men in Piekkola and Leijola (2007) in 7 European countries. Women instead gradually decrease the paid work burden over the life cycle. The consequent increase in house work is response to decreasing amount or paid work. This may allow women to stay longer in the labour market rather than the reverse. Apparently, husband is happier to retire, when he anticipates that spouse does a lot of house work (also for the benefit of husband), while this does not require the withdrawal of wife entirely from work.

An interesting finding is that a higher tertiary education level (university level), ceteris paribus, increases the probability of withdrawal from work by around 13-32%, most of this explained by withdrawal on an old-age pension below 65 years of age (see column 6). This is paradoxical as Huovinen and Piekkola (2001) show that pensioners in Finland, both on the unemployment or disability schemes, are generally low-income earners and have shorter educational histories. Here, option values and time use capture much of the difference by

education groups, namely that 43% of the highly educated are still working at the age of 60-64 versus 17% for other groups. The highly educated have higher option values for retirement postponement. The shift of option value of non-educated to that of highly educated (from 0.09 to 0.18) decreases retirement probability by 30-40%. Higher educated also have lower supply of house work. The share of home work from total work is 30% instead of 47% as for others (see table 1), which decreases retirement probability by 12%. Thus the traditional education effect is explained by better earnings potential when continuing to work (high option values), by less home work, and most likely also by better health. If we were to make the highly educated to work less (lessening earnings potential) and to do more house work the retirement patterns could match that for others.

Around 60% of the individuals reported being busy sometimes, while 7% of the males and 22% of the females consider themselves to be busy continuously, see table 1. Non-work time activities such as house work increase retirement propensity but here busy lifestyle appears to relate to work time activities. Here it is seen that a busy life style is associated with a longer stay in work life. This is especially true for the majority of the workforce who are busy only sometimes. The double burden of work and house work does not, as such, necessarily drive an individual from paid work. It may instead be the case that older workers with passive lifestyles with possibly no social ties live shorter lives and are thus motivated to retire.[5]

Among the early-retired individuals, those on disability pensions constitute an important group in explaining the possible effects of health on the workforce withdrawal. It can be claimed that a large number of these individuals are truly in poor health. We see that those who are busy continuously do not become disabled. The disability pension has also been used

[5] Patricia et al. (2002), using a social network index, show that men who have a large number of friends, relatives and other social ties may live a longer, healthier life than their socially isolated peers.

as a substitute for the unemployment pension, depending on which is cheaper for the firm (see Huovinen and Piekkola 2002). Those doing house work also tend to retire earlier although the self-reported health is not lower.

5. Conclusions

The possibility to combine working life and non-work time is not decreasing in importance as population is getting wealthier, have more accumulated pension rights and also have greater freedom to choose when to retire; a deliberate aim in many of the new pension systems. It is shown that non-work time opportunities are strong determinants of retirement and early retirement in particular. Piekkola and Leijola (2007) showed that the valuation of the increasing in home work after retirement leads to replacement rates close to 100%.

House work is not only be a close substitute for market work, but part of it rather mechanically follows from diminishing market work, or is comparable to active leisure. We use instruments that we believe will indicate how the house work patterns of an individual during his/her work life will affect their house work after retirement. This is especially important in explaining retirement of women, since much of the extra house work is done in response to diminishing working time, which, as such, may rather give opportunities to stay longer in working life. With these instruments, house work turned out to be a significant explanation for early retirement. A seven-hour increase in house work per week is associated with 12%-point increase in the probability to retire.

We, however, find asymmetric substitutability of house work, where husband’s decision to retire depends on how much wife supplies house work but not the other way around.

Apparently, husband is happier to retire, when he anticipates that spouse does a lot of house work (also for the benefit of husband), while this does not require the withdrawal of wife entirely from work. The house work done by husband can instead be closer to active leisure, which may not be shared (or enjoyed) by the wife. An example of such house work typical for men is renovation of home, fixing cars or some of the gardening.

New harmonized time use data allow us to go deeper in building up of retirement model, not relying entirely on pecuniary incentives. Especially for women, the actual amount house work done is directly a poor measure of the leisure element of house work. Modelling analogous to Graham and Green (1984) and Kerkhofs and Kooreman (2003) should use other proxies or instrument techniques to evaluate the leisure component of house work. Option for continuing to work should include the value of time constraints when not able to do active leisure what one would desire to do if retired. A proper valuation of non-work time in retirement should also incorporate the value of the increase in house work after retirement that is a substitute for market work. This is possible also because homogeneous groups (by gender, education and marital status) show similar patterns across countries, see Gershuny (2002) and Kooreman and Kapteyn (1987), especially evident in the new harmonized time use data, see Eurostat (2004).

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Appendix A. Finnish Pension Rules

Wage and consumer price index growth (pension incomes are indexed to these) follow the development for the years 1997-1999. The tax rates for the year 2000 were used in calculating real net incomes. Pension income is taxable income. The earnings-related pension depends on accrued pension rights during employment and on earnings in last 10 years. The pension accruals start accumulating from the age of 23. Accruals in the calculation of replacement rate vary over years. For the years before 1.7.1962 an employee acquires a pension rate of 0.5% per year. For the years following 1.7.1962 the pension rate is 1.5% per year. From the age of 60 on an employee acquires a pension rate of 2.5%. The maximum pension is 60% of the highest wage $W_{\max}$.

$$P = \min [rW, 0.6 * W_{\max}] \quad \text{(a.1)}$$

The pensionable salary *W* is the gross income net of the employee's pension contributions and corresponds to the average salary over the last 10 years of occupation. Pension index gives 0.5 weight on wage index (0.2 from age 65 on) and 0.5 weight on consumer price index (0.8 from age 65 on). The income earned after age 65 increases the accrual rate by 0.6% per month (but income is not taken into account in the calculation of pensionable salary). It is possible to retire from the age of 60 on. This actuarially reduces the level of pension payments by 0.4% for every month below age 65. We, however, assume that the employee has always access to more favorable unemployment pension pipeline or disability pension (with approximately same pension level as unemployment pension), see below.

The government pension is 428€ a month, 327€ for a married person, depending on the municipality of residence. This is reduced by one-half of the amount exceeding 35€ a month

of the pension based on employment contracts. It is not paid if the earnings-related pension exceeds 764-856€ a month, depending on municipality. A married person receives no pension if his earnings-related pension exceeds 754-785€ a month. (1998 figures). The pension income is taxable. Additional sickness insurance for pensioners is 2.7 (in addition to 1.5).

Unemployment pension

A special feature of the unemployment pension is that the people who turn 57 years during the unemployment period, i.e. when unemployment starts at the age of 55, are entitled to an extension of unemployment benefits until they turn 60 and start to receive unemployment pension. Unemployment pension is defined a

$$P_{unemp} = \min\ [(a+b+c)*(1+\sup),\ 0.6*W_{\max}]\ , \qquad \text{(a.2)}$$

where

a=Replacement rate at the time of unemployment at age 57 or after (accrual 12/800=0.015, and 0.025 as of age 60)

b=Upcoming pension until age 60: unemployment months until age 60 *W/1000 (yearly accrual 12/1000=0.012)

c=Upcoming pension since age 60: unemployment pension months until age 65 (60 or less) * W/ 1500 (yearly accrual 12/1500=0.008)

sup=Pension supplement after 500 days of unemployment if retired before age 60: 0.8 * unemployment months / (504 – unemployment months), where unemployment months = unemployment days until age 60/22 and 504 shows months between age 23 and 65.

Those born later than 1945 (younger than age 58 in 2002) are not entitled to the pension supplement until age 65. For those born before 1945 the pension supplement is also earned during a period of unemployment. This is equal to 0.8 times the number of months of unemployment times the pension divided by the remaining months until age 65.

Disability pension

An individual, who is suffering from reduced work capacity because of illness, handicap or injury, is entitled to disability benefits (this applies to 25 per cent of the age group 60-64). The individual early retirement scheme is a special type of disability pension paid to an individual aged between 58 and 64 whose work capacity has significantly diminished but who has had a long work career.

Disability pension consists of

$$P_{disability} = \min\ [(a+b+c+d),\ 0.6*W_{\max}] \qquad \text{(a.3)}$$

where

a=Replacement rate at the time of disability

b=Upcoming pension until age 50: Disability months until age 50 * W/800

c=Upcoming pension at age 50-59: Disability months at age 50-59 (120 or less) *W/1000

d= Upcoming pension at age 60-65: Disability months at age 60-64 (60 or less)*W/1500.

As of age 60 disability pension is equal to unemployment pension at the time the person is entitled to a disability pension (if disabled).

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