Retirement Behavior of Dutch Elderly Households.

Diversity in Retirement Patterns Across Different Household Types.

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Abstract

We specify and estimate retirement models for singles and married couples and estimate these on data from the Dutch Socio-Economic Panel. We perform some simulations and find strong effects of retirement options in determining the retirement behavior within different household types. Model estimates are used to simulate the effect of relevant retirement policies across subgroups. We find that the disadvantageous treatment of the old age pension in the Netherlands for married households with two earners has unintended perverse effects on the labor market behavior of couples.

1 Introduction

Pension receivers in the Netherlands obtain a substantial part of their pension benefit in the form of an old age pension (AOW). The AOW benefit is a flat benefit paid by the Social Security administration to all individuals older than 65. The level of the benefit depends on marital status and employment status of the receiver's spouse. This study aims to describe and explain retirement

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[0]This study is based on the Social Economic Panel survey administrated by Statistics Netherlands. The views expressed in this study are of the authors and do not necessarily reflect the views of Statistics Netherlands.

patterns of different types of households in the Netherlands. In particular we want to know to what extent the AOW is responsible for the observed differences in the retirement patterns of singles and couples. Indeed, the dependence of the AOW benefit of the oldest person in the household on the participation of the younger partner may affect household participation decisions in a perverse way.

The past three decades have shown a substantial decline in labor force participation rates of older workers across most industrialized countries and also in the Netherlands. However there appears to be considerable heterogeneity in retirement behavior of different demographic groups. Participation rates of single males are lower than the participation rates of their cohabiting counterparts. Retirement patterns of the heads with a working partner differ substantially from the patterns observed for heads with a non-working partner.

There is a fair amount of work on the individual retirement decision. It is generally acknowledged that financial incentives are relevant for the retirement decision, (Gruber and Wise 1997). However, financial variables alone can not explain all of the reduction in the participation rate of the past decades. For the US, for instance, Moffit (1987)estimates that financial incentives account for at most one third of the drop in the participation rate. This finding becomes relevant, when confronted with the large variation in the retirement trends of different demographic groups. It does not imply that financial incentives are not important, but that differences in the preferences for leisure and income between these different demographic groups may also matter. The large variation also hints that we may need different models for couples when we want to explain retirement behavior of two individuals in a household.

We specify and estimate retirement models for singles and married couples and estimate these on data from the Dutch Socio-Economic Panel (SEP). Model estimates are used to simulate the effect of relevant retirement policies across subgroups. We show that the disadvantageous treatment offered to the older spouse influences retirement behavior at older ages in a perverse way.

Retirement of spouses may be related for several reasons (see for instance Gustman and Steinmeier (2000)). Firstly, because work choices of one member may affect the financial rewards of work or non-work of the other (for instance, because of spill-over effects, see Coile (1999)). Secondly, because work outcomes of one member may affect the relative preference for income and leisure of the other member directly. Thirdly, because of related preferences of family members, other than the just mentioned possible causes[1]. Christensen and Datta Gupta (1994) and Coile (1999), focus on the first two reasons for association[2]. Gustman and Steinmeier (2000), take a more structural approach[3]. In Blau (1998)family retirement is viewed as the outcome of the maximization of a

[1]Related preferences may occur, for instance, if people with similar preferences match with each other (assortative matching)

[2]Their approach is to include individual characteristics, retirement options and labor supply choices of other family members as explanatory variables in a reduced form labor supply equation.

[3]They specify and estimate a structural model for the retirement behavior of spouses. In their model individual family members have perfect foresight and labor supply behavior follows from maximization of the individual utility functions subject to a family budget constraint.

household utility function, in an uncertain and dynamic environment. The main findings of the empirical studies on family retirement behavior is that there is an association between the retirement decision of head and wife. More specifically, retirement status of one member affects the transition probability of the other (Blau (1998)and Gustman and Steinmeier (2000)), there is evidence of coordination and this is not due to a coordination of opportunities that heads and wives face (Gustman and Steinmeier 2000) and that heads have at least as strong preferences for leisure as wives (Christensen and Datta Gupta 1994).

Our study is similar to the study of Blau (1998), but an important aspect differs. Our focus is both on the within family retirement dynamics, as well as differences in retirement behavior of married couples and singles. We view family retirement behavior as governed by the weighted sum of the individual utility functions of the head and partner. These individual utility functions may be related through direct effects (e.g. because labor supply decisions of one member affects the utility of the other directly), as well through similar unobserved preferences. The incentive variables capture the forward looking behavior of both the head and the partner and also the interactions between these. For these interactions, we exploit information on differences in the planning horizon of head and partner. In addition the results will be used to evaluate the effects of the AOW and eligibility rules in a broader sense.

The next section describes the Dutch institutional setting. Section 3 introduces the data and looks at the most relevant facts and trends in family composition and labor supply. Section 4 presents our model and the empirical implementation. Section 5 gives the results and 6 summarizes and concludes.

2 Institutions in the Netherlands

In this section, we provide a short description of the Dutch pension , early retirement (ER) and the social insurance system made up of unemployment insurance (UI), and disability insurance (DI).

The Dutch pension system consists of three tiers (see also Bovenberg and Meijdam (1999)and Alessie and Kapteyn (2001)). The first is Social Security (SS): everyone in the Netherlands is covered by an old age pension (AOW) starting at the age of 65. The second consists of funded occupational pensions. Finally, some retirees (e.g. the ex-self-employed) have privately bought a pension insurance in the past.

The level of the AOW benefit is independent of tenure, experience or other income, but does depend on household composition. The rule is that a couple of which both head and spouse are older than 65, receives in total an AOW benefit equal to the minimum wage. A single person is entitled to 70% of the minimum wage. This means that a family receives 50% of the minimum wage as AOW benefit if the younger partner is still at work, whereas an unmarried individual would receive 70% of the minimum wage. However, families may receive a supplementary AOW benefit of 20% if the income of the working partner is sufficiently low. In some cases it will be beneficial for the family that the younger partner retires. Given the focus of this study, we have explicitly taken into account the supplementary AOW rules in the computation of the value of retirement[4].

The second tier of the pension system consists of funded occupational pension plans. Most of these plans are of the defined benefit type and based on the final pay [5]. Family composition matters also in this case as occupational pensions are computed only for amounts exceeding the AOW-benefit of a couple (=100% of the minimum wage). However, members of two-earner families or single person households receive an AOW-benefit of 50% and 70% of the minimum wage, respectively. This means that up to retirement of the partner the family may face a sizable financial penalty.

The first two tiers of the system provide income for individuals aged 65 and older. However, only 20% of the males aged between 60-64 are still at work. It has been shown that strong incentives of employer provided Early Retirement (ER) and social security provided Unemployment Insurance (UI) and Disability Insurance (DI) programs are responsible for this [6].

Kapteyn and de Vos (1997), Heyma (2001)and Lindeboom (1999)have shown that the ER schemes in the Netherlands provide strong incentives to retire at the very moment that individuals become eligible for these schemes.

3 Data, facts and figures

We use the seven waves covering the period 1990 - 1996, of the Dutch Social Economic Panel (SEP)[7]. However, information of the specifics of the ER schemes, such as the age of eligibility and the benefit replacement rate, are not available. For this information we will use another data set called the CERRA survey [8].

In this study we present summary statistics of labor supply behavior of households of which the head[9] is aged 50 to 65 in any of the waves. Next, household members are divided into “head” and “partner”. We use the self-

[4]This system will not hold for younger cohorts that will become 65 in the next decade. For these and the younger generations there will be no means tested supplement of 50% and the individual AOW benefit will simply be 50% of the minimum wage regardless of the income of the partner.

[5]Most schemes aim at a benefit level such that the sum of before tax AOW benefits and before tax occupational pension benefits is equal to 70% of last earned gross wages. The after tax replacement rate can be substantially higher because retirees do not pay social insurance premiums.

[6]We refer to a companion study (Mastrogiacomo et al (2002)) for more details on the UI, DI and ER schemes.

[7]It is administrated by Statistics Netherlands (CBS) and contains approximately 5000 households per year. In structure and contents this panel survey is similar to the German Social Economic Panel (GSOEP) and the American PSID.

[8]Center for Economic Research on Retirement and Aging (see the companion study for a description).

[9]Statistics Netherlands defines the head as the man in the household or the “main income earner” if no man is present. This means that women may also be defined as heads. In addition any sort of cohabitation may constitute a household

reported information about the main activity for the employment status [10]. The self-employed are excluded from the sample as are the cases were we lacked information on essential variables like gender, marital status and employment status. We will assume in our model of the next section that retirement is an absorbing state. This assumption is violated in 2% of the cases. We also discarded these from our data. These sample selection criteria eventually leave us with information on 2957 couples and 1063 singles. Two types of descriptive analysis will be presented. First, data are presented for the repeated cross sections, next we restrict our sample to individuals who participate in at least two waves of the panel survey for the analysis of transition rates between the different labor market states.

We start with a description of the cross sectional information. Table 1 depicts patterns for labor supply over age for heads and partners. For heads the drop in labor participation is not very relevant at younger ages, but this changes after age 55, when individuals become eligible to ER schemes (the so called VUT schemes, see the Appendix to the companion study). The patterns also vary according to marital status.

Table 1: Labor market participation over age by marital status

Labor participation over age

Age	Married heads	Divorced	Widow	Never Married	Partners
50	88%	66%	67%	54%	30%
51	86%	58%	47%	51%	27%
52	86%	56%	47%	55%	23%
53	80%	49%	50%	63%	19%
54	79%	56%	40%	62%	16%
55	70%	45%	33%	68%	15%
56	65%	35%	29%	67%	13%
57	55%	32%	23%	59%	8%
58	44%	28%	23%	45%	10%
59	35%	24%	16%	42%	7%
60	19%	10%	9%	19%	6%
61	15%	8%	5%	11%	3%
62	10%	6%	3%	11%	3%
63	11%	5%	3%	17%	3%
64	9%	3%	2%	15%	2%
Observations	4857	805	710	489	4657

Explanatory note: Repeated cross section period 1990-1996. Source: SEP, own computations

These numbers say little about the division of labor supply within the household. Table 2 gives the participation rate of the heads, conditional on the labor force status of the partner. So, for instance, 91% of the 50 years old heads with a working partner are still at work, whereas somewhat less (87%) of the 50 years old heads with a non-working partner are.

Since we only consider two states: employed, or out of the labor force (OLF) we have four possible combinations for couples: both employed; one employed

[10] We have separated the individuals who reported "paid employment" from the rest (UI, DI, volunteers etc.)

Table 2: Head's labor market participation conditional on partners' participation

Head labor participation conditional on partner's participation		
Age of the head	If partner employed	If partner OLF
50	91%	87%
51	86%	86%
52	87%	85%
53	88%	77%
54	87%	77%
55	79%	68%
56	69%	64%
57	58%	54%
58	48%	43%
59	47%	33%
60	33%	17%
61	40%	12%
62	22%	9%
63	24%	10%
64	28%	8%
Observations	934	3923

Explanatory note: Repeated cross section period 1990-1996. Source: SEP, own computations

and the other OLF; both OLF. Table 3 displays family labor supply transition rates.

Table 3: Joint labor market transition rates in the married household

Transition rates through household labor participation states			
	Original labor market status of couples		
Labor market participation after one year	Both Employed	Head employed, partner not	Partner employed, head not
Both Employed	79%		
Head employed, partner not	14%	88%	
Partner employed, head not	5%		77%
Both out of the labor force	3%	12%	23%
Observations	679	1038	144

Explanatory note: Unbalance panel period 1990-1996. Source: SEP, own computations

The transitions are yearly changes from the state of origin to the state of destination. The diagonal of this table displays the persistence of the different family labor supply positions. About 79% of the couples where both are employed remain in the same situation after one year while about 14% of the partners stops working. It is interesting to note that when both are at work, it is more often the partner who stops earlier than the head. The situation where both are out of the labor force in the initial year is an absorbing state and is therefore not displayed in the table. Relatively high transition rates out of work are observed for partners with a non-working head. For singles the transition rate to OLF is approximately 11% (not displayed in this table).

To summarize this section, one can conclude that there are large differences between the behavior of different demographic groups. Singles have lower participation rates and higher exit rates out of work. For all groups, large drops in the participation rates are observed at or around the ages where the VUT schemes become effective. Retirement is an absorbing state as there is (almost) no return from non-work states to work. A substantial fraction of the married couples consist of a working head and a non-working partner. When the head is out of work, partners appear to have higher transition rates out of work.

4 A model for retirement behavior of couples and singles

In the previous sections it was concluded the Dutch Institutions provide strong incentives for the retired to remain retired and that this was confirmed by our data. As we will see below, this has consequences for our model of family retirement behavior.

Our model for couples is rather similar to the one of Blau (1998). In other words, we have formulated a discrete-choice, discrete time model of employment. Let $y_{i,t} = 1$ $i = h, p$ if household member i (h= head, p= partner) works in period t, and $y_{i,t} = 0$ if he/she is retired, or unemployed or disabled.[11]. We distinguish four different states indicated by the random variable $y_{f,t}$:

$$
\begin{aligned}
y_{f,t} &= 0 \text{ if } y_{h,t} = 0, y_{p,t} = 0 \text{ (both spouses unemployed)}\\
y_{f,t} &= 1 \text{ if } y_{h,t} = 1, y_{p,t} = 1 \text{ (both spouses employed)}\\
y_{f,t} &= 2 \text{ if } y_{h,t} = 1, y_{p,t} = 0 \text{ (only husband employed)}\\
y_{f,t} &= 3 \text{ if } y_{h,t} = 0, y_{p,t} = 1 \text{ (only partner employed)}
\end{aligned}
$$

We view retirement as the outcome of a maximization process, where each period head and partner make their own employment decisions. These decisions are governed by a comparison of the family utility streams associated with the different employment alternatives. In these alternatives it is recognized that current decisions affect future retirement benefits and income out of work. Blau (1998) assumes that preferences are given by a household utility function. In other words, he does not specify the bargaining process within the household. We make an attempt to do so. Suppose that the family lives in period τ. We suppose that the family's decisions on labor participation is the result of a Nash bargaining process, i.e. the family inter temporal utility function (U_τ) can be written as a weighted average of individual utility flows, i.e.

$$
V(\tau) = E_\tau U_\tau = E_\tau \left[\lambda U_\tau^h + (1-\lambda) U_\tau^p\right] \tag{1}
$$

where λ denotes the Nash bargaining parameter and $V(\tau)$ the value function in period τ. E_τ is the expectation operator based upon information available in

[11] We omit household specific subscripts for convenience

period τ. The intertemporal utility function of the head U_τ^h has the following form (the one of the partner, U_τ^p, is analogous and therefore omitted):

$$U_\tau^h = \sum_{t=\tau}^{T_h} (1+\rho)^{\tau-t} u_t^h(c_{h,t}, c_{p,t}, y_{h,t}, y_{p,t}) \tag{2}$$

where $c_{h,t}$ and $c_{p,t}$ denote consumption of the head and wife, respectively. ρ is a discount factor. T_h denotes the time horizon of the head. We assume that this time horizon is equal to the calendar year that the head becomes eligible for the AOW benefit (age 65): $T_h = \tau + (65 - age_{h,\tau})$. Notice that because of age difference, the partner has a different time horizon T_p than the head. In most cases the partner is younger than the head and therefore retires later in the future. Like Blau (1998) we allow for state dependency (i.e. the parameters of the family utility function (1) might depend on past labor participation choices. Therefore, we attach two subscripts j and k to the value function appearing in equation (1): $V_{jk}(\tau)$. Subscript $y_{f,\tau} = k$ denotes current-period labor force status of the couple ($k = 0, \ldots, 3$) and j the previous period status.

We can rewrite the decision problem of the household in a dynamic programming format. However, we do not solve the dynamic programming problem as part of the estimation. Instead, we follow the methodology of Blau (1998) and approximate the value function $V_{jk,\tau}$ as follows:

$$V_{jk}(\tau) = Z'_{k\tau}\theta_j + X'_\tau \beta_{jk} + \gamma_{jk}\mu + \epsilon_{k\tau} \tag{3}$$

where the $X's$ are exogenous variables affecting preferences ('taste shifters') and expectations. The vector X includes a constant term. μ is an unobserved time-invariant couple specific random effect. We assume that μ is independent across households and follows a normal distribution with expectation 0 and variance σ_μ^2. $\epsilon_{k\tau}$ follows an extreme value type I-distribution. We assume that $\epsilon_{k\tau}$ is uncorrelated over time and across alternatives.

The $Z's$ are state-specific 'incentive' variables. Since we allow for state dependency we index the parameter vector θ with the index j (labor force status of the couple in the previous period). Apart from exploiting the theoretical framework described above, we need to make some additional assumptions in order to construct these incentive variables. The first set of assumptions involves the specification of the inter temporal utility functions of the head and the partner. For the head it has the following form (for the moment we ignore the possibility that the preference functions may depend on taste shifters):

$$u_t^h(c_{h,t}, c_{p,t}, y_{h,t}, y_{p,t}) =$$

$$\alpha_{1h}^h c_{h,t} + \alpha_{1p}^h c_{p,t} + \alpha_{2h}^h y_{h,t} + \alpha_{2p}^h y_{p,t} + \alpha_{3h}^h y_{h,t} c_{h,t} + \alpha_{3p}^h y_{p,t} c_{p,t} \tag{4}$$

Both the head and the partner (that has an analogous $u_t^p(c_{h,t}, c_{p,t}, y_{h,t}, y_{p,t})$) yield utility from their own log(consumption) $c_{h,t}$ ($c_{p,t}$) and from spouses' log(consumption). The variables $y_{h,t}c_{h,t}$ and $y_{p,t}c_{p,t}$ are added to the utility functions in order to take into account possible non-separability between consumption and labor force participation.

Second, we assume that savings behavior is exogenous, i.e. consumption of head and partner is equal to their earnings (non-capital income). Third, we assume that if the head or partner choose to continue working in period τ, he/she remains working up to his/her early retirement age[12]. Empirical work of Lindeboom (1998)suggests that 80% of the employees goes directly into ER once he/she gets the opportunity to do so and that the other 20% retires within 1.5 years after the first opportunity. Heyma (2001)reports that 82% of the potential early retirees in the CERRA data, answering a question about their future plans, are willing to retire as soon as possible. The validity of the third assumption is also (partly) confirmed by the extreme high implicit tax rates (above 100%) which are implicitly levied on labor earnings at the ER age. This implicit tax rate are so high because the ER-entitlements are very generous and not actuarially fair (see Kapteyn and de Vos (1997)and Lindeboom (1999)). Fourth, retirement is an absorbing state. As said before, the Dutch institutions provide strong incentives for the retirees to remain retired. Finally, we assume that wage earnings (in real terms) are constant over time $wage_{h,t} = wage_{h,\tau-1}$, $t = \tau, \dots, T_h$, $wage_{p,t} = wage_{p,\tau-1}$, $t = \tau, \dots, T_p$. We have checked this assumption by estimating an age-earnings profile (a fixed effects model). It appears that the age coefficients in these wage regressions do not differ significantly from 0.

Given the assumptions mentioned above, the rules concerning social security, pension and early retirement (replacement rates etc.) and survival probabilities of head and partner, we are able to construct the following 'incentive' variables.

a The discounted sum from the current period τ to period T^* of the following six variables: 1) c_{ht} ($Z1^h_{1k}$), 2) c_{pt} ($Z1^p_{1k}$), 3) y_{ht} ($Z1^h_{2k}$), 4) y_{pt} ($Z1^p_{2k}$), 5) $y_{ht}c_{ht}$ ($Z1^h_{3k}$), 6) $y_{pt}c_{pt}$ ($Z1^p_{3k}$). T^* is equal to the time horizon of the partner, T_p, if the head is older than the partner, and to T_h otherwise. Notice that $Z1^h_{l1}$=$Z1^h_{l2}$, $l = 1, 2, 3$: for the states k=1 (both spouses working) and k=2 (only the head works), the incentive variables $Z1^h_{lk}$ take the same value. For similar reasons: $Z1^p_{l1}$=$Z1^p_{l3}$, $l = 1, 2, 3$.

b The discounted sum from period $min(T_h, T_p) + 1$ to period $max(T_h, T_p)$ of the following six variables if the head is younger than the partner: 1) c_{ht} ($Z2^h_{1k}$), 2) c_{pt} ($Z2^p_{1k}$), 3) y_{ht} ($Z2^h_{2k}$), 4) y_{pt} ($Z2^p_{2k}$), 5) $y_{ht}c_{ht}$ ($Z2^h_{3k}$),6) $y_{pt}c_{pt}$ ($Z3^p_{3k}$), $k = h, p$. If the head is older than the partner, the '$Z2$'-variables are equal to minus the discounted sums mentioned above.

[12] Some information on the ER age is missing in the SEP survey. The CERRA survey is used to estimate the sector specific probability distribution of the ER age. In the companion study (Mastrogiacomo et al. (2002)), it is explained how these probability distributions are used in the computation of the incentive variables. Basically, we compute the value of the incentive variables for all possible ER ages and then we take the expectation of incentive variables using probability distributions mentioned above.

Notice that the coefficients corresponding to the $Z2$-variables are only identified due to differences in the planning horizon of heads and spouse. We have computed the incentive variables for several values of the discount rate ρ (see the next section).

If one believes in the assumptions presented above, one may identify the preference parameters appearing in equation (2) up to the Nash bargaining parameter λ. For instance, the parameter corresponding $Z2^h_{1k}$ is equal to $\lambda\alpha^h_{1h}$ and that of $Z1^h_{1k}$ to $\lambda\alpha^h_{1h} + (1-\lambda)\alpha^p_{1h}$. If one knows λ, one can identify the two parameters α^h_{1h} and α^p_{1h}. However, in our opinion, the assumption which are needed to construct the Z-variables are too strong in order to claim that we identify the 'deep' underlying preference parameters of the family utility function. Like Blau (1998), we only use the theoretical framework as a guideline for the empirical specification of model (3). Notice, however, that in comparison with Blau (1998) we have exploited more elaborately the theoretical structure: in the formulation of the incentive variable we take into account that the labor participation choices of couples is the result of a bargaining process.

After having paid attention to the incentive variables, we have almost fully explained the value function (3). Suppose that the econometrician knows the value of μ (later on, we will relax this assumption). Model (3) implies the following transition probabilities, $\eta_{jk\tau}(\mu)$, from state j to state k:

$$\eta_{jk\tau}(\mu) = Pr(V_{jk}(\tau)) > V_{jm}(\tau)(j,1)\ \forall m \neq k \mid \mu, y_{f,\tau-1} = j) \qquad (5)$$

This expression boils down to a random effect multinomial logit model when ϵ is taken as an EV type I distribution. We simplify this model in some further directions. In the construction of the Z-variables, we assume that retirement is an absorbing state: $\eta_{00\tau}(\mu) = 1$, $\eta_{0l\tau}(\mu) = 0$, $l = 1,2,3$, $\eta_{l1\tau}(\mu) = 0$, $l = 2,3$, and $\eta_{32\tau}(\mu) = \eta_{23\tau}(\mu) = 0$. The absorbing state assumption, which is confirmed by the data, implies that in case of the initial labor force states $j = 2$ or 3, expression (5) boils down to a binary logit model. Moreover, we barely observe transitions from labor force status $y_{f\tau-1} = 1$ to $y_{f\tau} = 0$ (see table 3). Therefore we assume that $\eta_{10\tau}(\mu) = 0$. Finally we face the problem that we do not have many observations in which only the partner works in period $\tau - 1$. Therefore we assume that apart from the constant term $\beta_{2k} = \beta_{3k}$. Moreover, we assume that $\gamma_{2k} = \gamma_{3k}$. Finally, since in model (5) only utility differences are identified, we need to make the following normalizations: $\beta_{11} = \gamma_{11} = 0$, $\beta_{20} = \gamma_{20} = 0$ and $\gamma_{22} = 1$.

We could estimate the transition models under the assumption that the initial sample selection does not cause a bias in the estimated parameters. This assumption might be problematic. The reduced form model which explains family labor participation in the first period of observation has the following multinomial logit form:

$$V_1(l) = X_1'\omega_l + \kappa_l\mu + \upsilon_l, l = 0,1,2,3$$

$$I_l(\mu) = Pr(y_{f,1} = l) = Pr(V_1(l) > V_1(j)\ \forall j \neq l) \qquad (6)$$

Obviously, for identification purposes we have to assume that $\omega_0 = \kappa_0 = \upsilon_0 = 0$. Notice that the household effect μ appear both in the transition models (like equation (5)) and the initial condition equation (6). The likelihood contribution per household has the following form:

$$\pounds = \int (\sum_{j=0}^{3} d_{j1} I_j(\mu)) \prod_{t=2}^{T} \left[\sum_{k=0}^{3} \sum_{l=0}^{3} d_{klt} \eta_{klt}(\mu) \right] g(\mu) d\mu \tag{7}$$

where $d_{klt} = 1$ if the couple moves from state k in period $t-1$ to state l in period t and equal to 0 otherwise. $d_{j1} = 1$ if couple is in state j in the initial period 1, and 0 otherwise. $I_j(\mu)$ is the corresponding probability. Instead of maximizing the likelihood 7, we estimate the model by means of simulated maximum likelihood (150 draws).

We will also estimate a model for singles. This model is rather similar to the one of couples. In other words, the model consists of two parts: *a*) a binary logit transition model from work to non-participation, very much in the spirit of model (3) and *b*) an initial condition equation which is rather similar to equation (6). In the transition model we only have three incentive variables instead of twelve: the $Z2$- and $Z1^p$-variables are not relevant because no partner is present.

5 Results

The discrete-time discrete-choice model is estimated for couples and singles (SI)[13]. Summary statistics are in table 4. The results of the main models are presented in table 5 (couples) and table 6 (singles)[14], respectively[15]. In the estimation we have assumed that the rate of time preference (discount factor) is equal to zero when we calculate the incentive variables. We have also estimated the model with $\rho = 0.1$. However, we obtained lower log-likelihood values in that case. In both models the "unobserved heterogeneity coefficients" (i.e σ_μ and ρ in table 6, and σ_μ, the γ and κ-parameters in table 5 and 8) are not jointly significant, although σ_μ differs significantly from 0 in the couples model. Given this result, we have also estimated (multinomial) logit models explaining labor force transitions out of work of the head and the partner (if present). The parameter estimates are rather similar to the ones reported in tables 5 and 6. It also appears that the transition models without unobserved heterogeneity fit the data quite reasonably: The pseudo-R^2 are equal to 0.327 (two-earner couples), 0.397 (one-earner couple) and 0.369 (singles).

[13] The parameters estimates of the initial conditions equation for couples and singles are given in table 8.

[14] The results are generated using Ox version 3.30 (see Doornik, 2002) and the Arfima package version 1.00 (Doornik and Ooms, 1999).

[15] In these tables we report (multinomial) logit coefficients. However in this section we also discuss some marginal effects. More information about is available from the corresponding author.

In table 5, the upper panel of the table includes time effects and the taste shifters whereas the lower panel presents the estimates of the coefficients associated with the incentive variables and the parameters of the mixing distribution. The first columns refer to estimates of the model, when in the initial state the household is made up of two earners (TE). In the next period both could again be at work or either of them could be out of work. We assumed absence of direct shifts into joint retirement ($y_{f,t-1} = 1$, $y_{f,t} = 0$). This occurred in only 3% of the sample and prevented us from obtaining reliable estimates for the model. We took the situation where both are employed as the reference group in this random effects multinomial logit model.

The last two columns of table 5 refer to estimates of the model for one earner (OE) couples. As discussed in the previous section in these estimates the observations of $y_f = 2$ and $y_f = 3$ are lumped together. We restricted the set of year dummies and the coefficients of the taste shifters to be equal for the two groups of OE. However, via a dummy variable, we allow for some differences between them. The coefficient associated with this dummy variable takes a significantly negative value, meaning that in a OE couple a working partner has a higher labor force exit than a working head. The model is flexible in one other respect: we allow for complete separate sets of estimates of the effect of the incentives variables $Z1$ and $Z2$.[16]

It has to be noted that for all household groups (SI, OE and TE households) most of the time effects and the taste shifters do not explain family labor force transition rates. An important exception are the highly educated. In case of singles and OE couples, heads with the high education level have a lower tendency to exit the labor force than head with a low education (the reference group). The size of the marginal effect is rather similar across singles and OE couples: for the average single the head's labor force exit rate of the highly educated is about 4 percent points lower than that of the low educated. For the average OE head is trifle lower: 3.4% points. However, the lagged working status of the partner matters: the effect of education is negligible in case of TE couples. In the model explaining labor force participation of singles, one other variable rather seems to be important, namely marital status: the divorced and the widowed remain longer at work, as compared to the never married. The estimated marginal effects suggest that the labor force exit rate of the never married is 3.8 percent points higher. Presumably, in comparison with people who never married, the divorced need to work longer because they need to pay alimony.

Contrary to the coefficients corresponding to the taste shifters, the coefficients associated with the incentive variables (the $Z-$variables) are very significant. It is difficult to interpret such coefficients directly. The $Z2's$, however, are included in the specification because of the differences in the time horizon of head and his partner. This difference in the time horizon is exploited in the (financial) incentives variables. So, as a first test for the differences in the plan-

[16]We also estimated a model, where the estimates θ's were restricted to be equal for both groups ($y_f = 2$ and $y_f = 3$). This restriction was strongly rejected by the data.

ning horizon of head and partner one could look at the statistical significance of these parameters. A quick glance at the table reveals that the $Z2$-variables matter. Indeed, the parameters associated to those variables are jointly significant ($\chi^2_6 = 16.9$).

5.1 Simulations results

As discussed above, direct interpretation of the parameters associated with the incentives variables is not straightforward. This is of no particular concern since we use these estimates to perform some calculations with the model. We will discuss these below.

In the first simulation we ask the following question: suppose that the heads of households will experience a 10% (permanent) wage increase: by how much will the labor force exit rate of the working head and partner (if present) change? Obviously, some of the incentive variables change as a result of this wage increase. For instance, let's consider the $Z1^h_1$-variable, i.e. the (discounted) sum of head's log(consumption) (=non-capital income).[17]. If the head chooses to continue working, the value of the $Z1^h_1$-variable (denoted by $Z1^h_{11}$) increases due to the wage increase. However, the value of the $Z1^h_1$-variable ($Z1^h_{10}$) also increases if the head chooses to exit the labor force because UI-, DI-, ER-benefits and compulsory occupational pensions are related to labor earnings. But in the Netherlands this relation is less than proportional and changes over the entitlement period, i.e. the gap between $Z1^h_{11}$ and $Z1^h_{10}$ becomes bigger as a result of the wage increase. Among other things, the choice between working and not working is determined by this gap. Another incentive variable which is affected by the wage increase, is $Z1^h_3$: the (discounted) sum of the interaction between the head's labor force participation and head's log(consumption). Obviously, the gap between $Z1^h_{31}$ and $Z1^h_{30}$ also increase due to the wage increase. The only incentive variables referring to the head which do not change due to the wage increase, are $Z1^h_2$ and $Z2^h_2$ because they do not depend on the income level (see previous section for the definition of these variables).

Our calculations suggest that as a result of the wage increase the labor force exit rate of the average single decreases by 3.2%-points from 4.3% to 1.1%. In relative terms, this effect is rather high. The effect is rather different for couples. For the average OE couple with a working head, labor force participation is negatively related to the wage rate (contrary to the singles): the transition rate out of work increases by 1%-point (from 3.1% to 4.1%). A working partner in an OE couple (in which the head is OLF) reacts to a 10% wage increase by staying longer in the labor force. This means that the labor force exit rate of an average OE couple with a working partner decreases by 1% point (from 17.8% to 16.8%). Labor supply of TE couples is also not much affected by a 10% rise in the wage rate of the head: the labor force exit rate of the average head increases by 0.5%-points (from 1.6% to 2.1%) whereas the labor supply choices

[17] As we already explained in the previous section, the sum is taken over the period τ (current period) until T_p (year of retirement of the partner if the head is older than the partner, T_h otherwise). Since we assume that $\rho = 0$, we basically take the un-discounted sum.

of the average TE partner are barely affected by the increase in income of the head. However, results are different if the wage of partner is increased by 10% instead of that of the husband. In that case, the average partner has a higher tendency to remain in the work force: her labor force exit rate decreases by 0.4%-points (from 5% to 4.6%). The head does not adjust his labor supply as a result of the rise in the partner's wage.

Because of the significance and the economic consistency of most of the estimated parameters and the marginal effects just described we feel confident to use the estimation results further. We perform some simulations in order to decompose the observed differences in retirement trends of heads of the different demographic subgroups and of the partners. These are decomposed into differences in parameters and differences characteristics. In addition, we also simulate a policy change that exogenously affects the level of the AOW benefit. We first describe the Oaxaca decomposition results in table 7.

In the Oaxaca decomposition we use in turn each group (SI, OE, TE) as a base. The decomposition formulas are also reported in table 7. The table decomposes the effects of parameters and characteristics in the hazard. We report in bold the predicted average hazard rate (this is denoted by $L^i = 1 - y$, $i = h, p$) within the model. The other figures give predictions where the 'incentive variables' are interchanged across different models. This means that when we read the table vertically we are holding constant the estimated parameters. When we read the table horizontally we hold constant the incentive variables (and consequently vary the $\beta' s$ the $\theta' s$ and the $X' s$). The decomposition shows that the hazard of the different groups (excluding the within model prediction) does not vary much across the different set of parameters (columns). For instance, in the first row, the incentive variables of TE households return a very low hazard both for OE heads (0.1%) and SI heads (0.2%) models. However, the same small variation does not hold when the incentive variables are interchanged. In the second column we observe that the hazard rate of the TE partners decreases from 13.9% to 9.3% and then to 6% when the TE head receives the average incentives available to the SI head or to the OE head (Z_{SI} and Z_{OE} respectively).

In the same table we also report the AOW policy simulation in which the AOW benefit of the head is made independent from income and labor participation of the partner. To be more precise we exogenously increase the TE head's AOW benefit after age 65[18]. We hold constant the model estimates and the taste shifters of TE household ($\beta' s$, $\theta' s$ and $X' s$) and impute a simulated vector of incentive variables to the TE head (Z^h_{sim}). We compute again average predictions and find that the hazard of the partner diminishes in the whole sample while the one of the head remains constant. This might indicate that removing the penalization for the TE head of a lower AOW benefit depending on partner's income and participation does not modify his hazard. However the partner shows a tendency to continue working (the hazard diminishes slightly from 13,9% to 13%).

[18]The policy relevance of this simulation is explained in section 2.

6 Summary and Conclusions

Large variations are observed in the retirement patterns of different types of households in the Netherlands. Singles have lower participation rates and higher exit rates out of work than married heads. In addition when the head is out of work, partners appear to have higher transition rates out of work. This study focuses on the relative importance in responses of the different types of households to specific retirement incentives. In the Netherlands the old age pension benefit is reduced to individuals who are married to a working spouse. We have approached the analysis of the Socio-Economic Panel data with dynamic models for family retirement behavior that acknowledge these institutional features. Model estimates are used to decompose the differences in transition probabilities as determined by differences in parameters and characteristics (i.e. the retirement options available to the different household types). We also used these estimates to simulate a 10% wage increase and an exogenous increase of the old age pension benefit for the head of a two earners household.

The empirical results and the simulation results can be summarized as follows:

- In general, we have obtained rather plausible estimation results for the most interesting parameters.
- The wage simulation shows that singles react strongly to incentives. Low cross wage effects between working spouses are evident. Heads respond to a wage rise by increasing a bit their labor force exit rate. The response of the partner goes in the opposite direction.
- Incentive variables and retirement options are a relevant determinant of retirement behavior. Differences in parameters do not 'explain' much of the variation in the exit rates among groups.
- The AOW policy simulation suggests that, when we increase the old age pension benefit to the two-earners head, the hazard of the partner might diminish. This might imply that conditioning one's pension benefit on the labor market status of the spouse might induce the spouse to retire earlier, rather than the individual to work longer.

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Estimation results

Table 4: Summary statistics: Two Earners and One Earner couples.

Summary statistics	One Earner households		Two Earners households	
	Mean	Standard deviation	Mean	Standard deviation
Year is 1992	0.16	0.4	0.14	0.4
Year is 1993	0.17	0.4	0.17	0.4
Year is 1994	0.15	0.4	0.18	0.4
Year is 1995	0.16	0.4	0.20	0.4
Year is 1996	0.20	0.4	0.16	0.4
Head intermediate vocational education	0.40	0.5	0.45	0.5
Head higher education	0.24	0.4	0.26	0.4
Partner intermediate vocational education	0.23	0.4	0.23	0.4
Partner higher education	0.32	0.5	0.36	0.5
With dependent children	0.43	0.5	0.47	0.5
$Z1^h_1$	9.23	8.6	13.85	9.3
$Z2^h_1$	-2.52	4.5	-4.40	5.8
$Z1^h_2$	5.06	3.0	6.65	2.6
$Z2^h_2$	0.08	0.3	0.05	0.3
$Z1^h_3$	56.09	33.6	73.47	28.6
$Z2^h_3$	0.85	3.9	0.59	3.0
$Z1^p_1$	-0.17	5.4	4.49	14.3
$Z2^p_1$	0.13	3.5	-1.13	5.6
$Z1^p_2$	1.14	3.6	13.57	5.4
$Z2^p_2$	-0.34	1.4	-2.61	3.4
$Z1^p_3$			83.35	31.7
$Z2^p_3$			-26.1	34.9
Dummy head OLF ($y^f_{t-1}=3$)	0.11	0.3		
Observations	1158		659	

Explanatory note: Summary statistics do not include the observations used for the initial condition equation

Table 5: Estimation results, model for couples: Two Earners and One Earner

Estimation results: model for couples

	Lagged state: Two earners couples (Reference group: both employed)				Lagged state: One earners couples (Reference group: working spouse employed)	
	Partner retires		*Head retires*		*Working spouse retires*	
	estimate	t-value	estimate	t-value	estimate	t-value
Constant	-0.96	-1.26	-1.41	-1.43	2.79	3.87
Time effects						
Year is 1992	-0.51	-0.75	-0.15	-0.20	-0.30	-0.69
Year is 1993	-1.26	-1.61	-0.73	-0.91	-0.41	-0.92
Year is 1994	-0.17	-0.24	0.04	0.05	0.10	-0.19
Year is 1995	2.81	3.91	-0.48	-0.48	-0.66	-1.35
Year is 1996	1.20	1.63	0.72	0.93	-0.52	-1.08
Taste shifters						
Head intermediate vocational education	1.06	1.67	0.003	0.004	-0.30	-0.85
Head higher education	0.75	1.35	-0.08	-0.12	1.30	3.17
Partner intermediate vocational education	-0.13	-0.26	1.19	1.67	0.10	0.26
Partner higher education	-0.74	-1.16	0.54	0.81	0.18	0.51
With dependent children	0.12	0.34	-0.01	-0.02	0.24	0.78
Dummy head OLF ($y^f_{\tau-1}$=3)					-2.97	-3.26

Incentive variables	estimate	t-value	estimate	t-value	estimate	t-value
$Z1^h_1$	-0.21	-1.96	0.66	6.74		
$Z2^h_1$	-0.21	-2.00	0.67	6.09		
$Z1^h_2$	-8.08	-4.08	14.35	8.15		
$Z2^h_2$	7.85	1.79	18.86	1.82		
$Z1^h_3$	0.71	3.79	-1.36	-8.06		
$Z2^h_3$	-0.60	-1.58	-1.81	-1.93		
$Z1^p_1$	-0.10	-4.66			0.16	2.90
$Z2^p_1$	-0.07	-1.25			0.17	2.38
$Z1^p_2$	-0.41	-3.86			0.34	3.13
$Z2^p_2$	-0.66	-2.64			0.41	2.81
$Z1^p_3$	0.03	2.37				
$Z2^p_3$	0.03	1.36				

Other statistics		
σ_μ	0.95	2.08
γ_{12}	0.17	0.39
γ_{13}	-0.44	-0.54
Pseudo R^2	0.327	
Observations	2957	
Log Likelihood	-1345.28	

Explanatory note: Multinomial logit coefficients. Reference groups: Year 1991, Elementary education, $y_{f,\tau-1} = 2$, γ_2. The variance of the individual term is significant however a test for the joint significance of this term and the gamma's is rejected. OLF = out of the labor force Source: SEP, own computations.

Table 6: Estimation results: model for singles

Estimation results: model for singles	Reference group: Head OLF		
	estimate	st.err.	t-value
Constant	2.97	1.00	2.97
Time effects			
Year is 1992	0.84	0.67	1.24
Year is 1993	0.42	0.61	0.70
Year is 1994	0.54	0.69	0.78
Year is 1995	-0.15	0.62	-0.24
Year is 1996	0.51	0.65	0.78
Taste shifters			
Male	-0.08	0.43	-0.19
Intermediate vocational education	0.65	0.46	1.43
Higher education	1.32	0.52	2.55
Divorced	0.94	0.48	1.97
Widow	1.20	0.51	2.38
With dependent children	-0.19	0.49	-0.39
Incentive variables			
$ZI^h{}_1$	0.79	0.12	6.80
$ZI^h{}_2$	11.64	1.52	7.65
$ZI^h{}_3$	-1.17	0.16	-7.53
Other statistics			
γ	0	0	-
σ_μ	-0.06	0.36	-0.17
Pseudo R^2	0.369		
Log Likelihood	-348.34		
Observations	1063		

Explanatory note: Logit coefficients. Reference groups: Year 1991, Female, Elementary education, Never married singles. The likelihood ratio test for the omission of γ and σ was rejected. OLF=out of the labour force. Source: SEP, own computations

Table 7: Post estimation predictions. A decomposition and a policy simulation

Post estimation predictions: decomposition of the hazard rate and policy simulation

	Decomposition			
	Model for couples			*Model for singles*
	Two earners households		One earners households	
	Head	Partner	Head	Head
Incentives two earners	**5%** $E\,(L_h \mid \beta_{TE}, \theta_{TE}, X_{TE}, Z_{TE})$	**13.9%** $E\,(L_p \mid \beta_{TE}, \theta_{TE}, X_{TE}, Z_{TE})$	0.1% $E\,(L_h \mid \beta_{OE}, \theta_{OE}, X_{OE}, Z_{TE})$	0.2% $E\,(L_h \mid \beta_{SI}, \theta_{SI}, X_{SI}, Z_{TE})$
Incentives one earner	3.2% $E\,(L_h \mid \beta_{TE}, \theta_{TE}, X_{TE}, Z_{OE})$	6% $E\,(L_p \mid \beta_{TE}, \theta_{TE}, X_{TE}, Z_{OE})$	**13.3%** $E\,(L_h \mid \beta_{OE}, \theta_{OE}, X_{OE}, Z_{OE})$	2% $E\,(L_h \mid \beta_{SI}, \theta_{SI}, X_{SI}, Z_{OE})$
Incentives single head	19.5% $E\,(L_h \mid \beta_{TE}, \theta_{TE}, X_{TE}, Z_{SI})$	9.3% $E\,(L_p \mid \beta_{TE}, \theta_{TE}, X_{TE}, Z_{SI})$	22% $E\,(L_h \mid \beta_{OE}, \theta_{OE}, X_{OE}, Z_{SI})$	**10.7%** $E\,(L_h \mid \beta_{SI}, \theta_{SI}, X_{SI}, Z_{SI})$
	Policy simulation			
Two earners couples heads receive entire AOW (whole sample)	4.9% $E\,(L_h \mid \beta_{TE}, \theta_{TE}, X_{TE}, Z^h_{sim})$	13% $E\,(L_p \mid \beta_{TE}, \theta_{TE}, X_{TE}, Z^h_{sim})$		
Two earners couples heads receive entire AOW (sub-sample with head older than the partner)	4.9% $E\,(L_h \mid \beta_{TE}, \theta_{TE}, X_{TE}, Z^h_{sim})$	13% $E\,(L_p \mid \beta_{TE}, \theta_{TE}, X_{TE}, Z^h_{sim})$		

Explanatory note: Simulations are carried out holding constant the model estimates for couples and singles. Then the new incentive variables are imputed and the post estimation prediction of the hazard rate into retirement is re-run. Z^h_{sim} is the imputed vector of incentive variables of the head when his AOW is increased by 50% and made not conditional on the partner state. OE=one earner; TE=two earners; SI=singles; L=hazard into retirement. All figures in the table are computed as averages of the individual predictions

Table 8: Initial conditions equations

Initial conditions equations								
	Singles (Reference case: Head OLF)		*Married couples (Reference case: Both OLF)*					
			Both employed		Only partner OLF		Only head OLF	
	estimate	t-value	estimate	t-value	estimate	t-value	estimate	t-value
Constant	9.56	3.97	15.27	6.80	14.44	9.74	3.90	1.59
Year is 1991			1.98	3.44	0.86	1.97	1.10	1.54
Year is 1992			-0.47	-1.18	-0.07	-0.26	-0.44	-0.90
Year is 1993			0.86	1.61	0.08	0.19	0.52	0.82
Year is 1994			0.70	1.49	0.26	0.65	0.23	0.40
Year is 1995			0.02	0.04	0.52	1.04	0.47	0.69
Year is 1996			-0.18	-0.35	0.42	1.00	0.40	0.66
Age head/10	-2.20	-8.34	-2.12	-5.01	-2.15	-6.93	0.56	1.18
Age partner/10			-1.63	-5.02	-0.64	-2.48	-1.65	-4.67
With dependent children	0.34	1.34	0.21	0.75	0.39	1.91	-0.01	-0.02
Head intermediate vocational education	0.74	2.82	0.78	2.50	0.39	1.83	0.28	0.75
Head higher education	0.45	1.42	1.18	3.38	1.00	3.70	0.21	0.44
Partner intermediate vocational education			0.10	0.08	0.24	0.04	0.19	0.00
Partner higher education			0.63	1.86	0.55	2.11	0.38	0.94
Total earnings head	0.26	1.57	0.03	0.29	0.08	1.48	-0.21	-3.41
Total earnings partner			0.51	10.87	-0.04	-1.84	0.36	7.56
Divorced	-0.48	-1.59						
Widow	-0.84	-2.60						
Male	-0.51	-2.09						
Civil servant	3.28	5.12						
k_1			-0.07	-0.14				
k_2			0.17	0.39				
k_3			-0.44	-0.54				

Explanatory note: Reference groups: Year 1990, Elementary education, Never married singles. For total earnings we have computed the inverse hyperbolic sine $f(x)= log\left(x+\sqrt{x^2+1}\right)$. OLF = out of the labor force. Source: SEP, own computations