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Retirement Behaviour of Dutch Elderly Households: Diversity in Retirement Patterns Across Different Household Types.

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Abstract

This paper aims to assess the relative importance of differences in behavioural responses to financial incentives in explaining the observed variation in retirement behaviour across different types of households. We specify and estimate models for singles and married couples and estimate these on data from the Dutch Socio-Economic Panel. Model estimates are used to decompose the observed differences in retirement trends of the different demographic subgroups into differences in preferences and differences in the availability and generosity of the retirement options.

1 Introduction

This paper aims to assess the relative importance of differences in behavioural responses to financial incentives in explaining the observed variation in retirement behaviour across different types of households. The past three decades have shown a substantial decline in labour force participation rates of older workers across most industrialised countries. For the Netherlands this trend has been most severe, both for males and for females. For males, participation rates of the 55 years and above were about 80% in the mid-seventies and this number has declined to about a little over 40% by the end of the nineties.

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Despite this general downward trend, there appears to be considerable heterogeneity in retirement behaviour of different demographic groups. For instance, participation rates of single males are substantially lower then the participation rate of their cohabiting counterparts. Retirement patterns of males with a working partner differs substantially from the patterns observed for males with a non-working partner. Furthermore, differences in retirement behaviour exist between widowers, the divorced and other single male workers. For females the participation rate of those aged 55 - 65 was relatively constant (17%). The constant participation rate is the result of two opposing trends: the trend towards increased participation of females across all age groups and the general trend towards earlier retirement. Changes in the demographic structure of the population are foreseen and, consequently, this in itself will generate changes in aggregate participation rates, regardless of any policy intervention [1]. This calls for a better understanding of the forces that drive the observed behavioural differences across the different demographic groups.

There is a fair amount of work on the individual retirement decision. The larger part of these studies concern the effect of financial incentives on individual retirement decisions. In these studies, retirement is viewed as the outcome of a rational comparison of the different retirement options that become available over time. It is generally acknowledged that financial incentives are important for the retirement decision, see for instance the study of Gruber and Wise (1997)and the survey paper of Lumsdaine and Mitchell (2000). Yet, many observers agree that financial variables alone can not account for 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 [2]. This finding becomes particularly relevant, when confronted with the observed heterogeneity in the retirement trends of different demographic groups. It then hints at the relevance of differences in preferences for leisure and income of different demographic groups or differences in the availability and generosity of the retirement options for these groups. It furthermore questions whether a model of individual behaviour, where the behavioural differences between singles and couples is most frequently accounted for by exogenous indicators, is adequate to capture the (within) family dynamics of retirement behaviour. Indeed, retirement behaviour of household members need to be modelled explicitly. This is the approach taken in this paper. We specify and estimate models for singles and married couples and estimate these on data from the Dutch Socio-Economic Panel. Model estimates are used to decompose the observed differences in retirement trends of the different demographic subgroups into differences in preferences and differences in the availability and generosity of the retirement options.

In contrast to the large amount of individual studies, relatively few studies exist that deal with the retirement behaviour of members within a household. Retirement of members within a household may be related for several reasons

[1] With focus on differences in marital status, rather then differences between age cohorts.

[2] For European countries higher numbers are expected as these countries have institutions with stronger incentives towards early retirement.

(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[3]. Thirdly, because of related preferences of family members, other then the just mentioned possible causes [4]. The larger part of the studies on retirement behaviour of couples focuses on the interrelation between labour supply decision of a head and a partner, taking one or more of the above mentioned reasons for association explicitly or implicitly into account. For instance,Christensen and Gupta (1994)and Coile (1999), focus on the first two reasons for association. Their approach is to include individual characteristics, retirement options and labour supply choices of other family members as explanatory variables in a reduced form labour supply equation. Gustman and Steinmeier (2000), take a more structural approach. They specify and estimate a structural model for the retirement behaviour of spouses. In their model individual family members have perfect foresight and labour supply behaviour follows from maximisation of the individual utility functions subject to a family budget constraint. In Blau (1998)family retirement is viewed as the outcome of the maximisation of a household utility function, in an uncertain and dynamic environment. The main findings of the empirical studies on family retirement behaviour is that there is an association between the retirement decision of husband and wife. More specifically, retirement status of one members 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 husbands and wives face (Gustman and Steinmeier 2000)) and that husbands have at least as strong preferences for leisure as wives (Christensen and Gupta 1994)).

Our study differs from the earlier research on family retirement behaviour. We view family retirement behaviour 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 labour supply decisions of one member affects the utility of the other directly), as well through similar unobserved preferences. We exploit information on differences in the planning horizon of head and spouse to identify the most relevant preference parameters of the model. Our approach is quasi-structural in the sense that we use specifics of the dutch Institutions, to simplify the dynamic programming framework considerably. Most importantly, our focus is both on the within family retirement dynamics, as well as differences in retirement behaviour of married couples on the one hand and singles on the other.

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 labour supply. Section 4 presents our theoretical model and

[3]These work outcomes can be the consequences of voluntary choices regarding work as the result of some underlying (bargaining) process or as a result of a demand driven shock.

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

the empirical implementation of the model. 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 (plus early retirement) and the social insurance system made up of unemployment insurance benefits (UI), and disability benefits (DI). We especially focus on those elements which are relevant for the computation of option values associated with the options "labour participation", early retirement and/or disability. Obviously, we need those option values in the estimation of our models (see Section 4 of the paper).

The pension system consists of three tiers (see also Bovenberg and Meijdam (1999)and Alessie and Kapteyn (2001)for an extensive description of the Dutch pension system). The first tier is Social Security (SS): everyone in The Netherlands is covered by a general old age pension (AOW) starting at the age of 65. The second tier of the pension system consists of funded occupational pension plans. Finally, some retired (e.g. the ex-self-employed) have privately bought a pension insurance in the past (this is the third tier of the pension system). As a result, they receive an annuity income from this insurance policy.[5]

The level of the AOW benefits is independent of tenure, experience or other income, but does depend on household composition. In principle, every individual older than 65 receives an AOW benefit equal to 50% of the minimum wage. This rule implies that a couple of which both head and spouse are older than 65, receives a SS benefit equal to the minimum wage. A single person household is entitled to a supplement of 20% of the minimum wage so that such a household receives 70 percent of the minimum wage. There are special rules for couples of which only one of the household members is older than 65. In any case, they are entitled to a AOW benefit of a single individual. Moreover, such a household may receive a supplementary AOW benefit which is negatively related to the earnings of the younger (<65) spouse: if the earnings of the younger spouse are high, the household is not entitled to a supplementary benefit. The maximum supplementary AOW benefit is equal to 50% of the minimum wage. Given the focus of this paper (retirement behaviour of couples and singles), we have explicitly taken into account the supplementary AOW rules in the computation of option values.

The second tier of the pension system consists of funded occupational pension plans. In general, if the employer offers a pension scheme, participation in such a scheme is compulsory. Although there is a great variety in pension schemes, the vast majority of the occupational pensions are of the defined benefit type. In most cases benefits are determined on the basis of final pay. 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 final earnings

[5] In the computation of option values we have ignored this third pillar of the pension system.

also before taxes[6]. This replacement rate is reached if one works for forty years with the same pension fund (implying an annual accrual rate of 1.75%). In practice, many workers do not achieve the 70% final-wage aspiration level because of incomplete careers. Furthermore, even in the case of full careers, two-earner families and single person households get less than 70% because the threshold is based on a AOW-benefit of a couple (=100% of the minimum wage). However, members of two-earner families or single person households , receive only a AOW-benefit of , respectively, 50% and 70% of the minimum wage.

The pension system described above provides income streams from age 65 onwards. However, on average about only 20% of the males aged between 60-64 are still at work. Generally it is believed that the strong incentive effects of employer provided early retirement schemes may be responsible for this. In the 80's and 90's, the larger share of the employers (about 80%) provided the so-called VUT or early retirement (ER) schemes. The ER schemes which were generally financed on a pay-as-you-go basis, were characterized by its easy access and generous benefits levels[7]. Eligibility of the ER retirement schemes was typically at the age of 60 or 61 and usually required ten years of tenure with the same employer. Furthermore, while being in retirement, one often keeps accumulating pension rights though possibly at a lower rate than when one would be working. Kapteyn and de Vos (1997)and Lindeboom (1999)have shown that these schemes provide strong incentives to retire, at the very moment that individuals become eligible for these schemes. More specifically, once eligible, delayed retirement does not lead to higher early retirement benefit replacement rates. Consequently, implicit tax rates of these schemes become very high at the very moment that an individuals qualifies for benefits.

Yet, prior to the age of eligibility for ER, a substantive part of the elderly has already left the labour force. This pattern can be explained by the Dutch Social Insurance system. It provides, among other things, Unemployment Insurance (UI) benefits and Disability Insurance (DI) benefits. Unemployment Insurance benefits are provided to protect for loss of income due to involuntary unemployment. Benefit levels are 70% of last earned wages [8]. The benefit entitlement period for the earnings related UI benefit depends on an individuals' work history, but can be at most 5 years. After exhaustion of UI benefit entitlement, benefits are reduced to Social Assistance (SA) benefits, that are 70% of the minimum wage. Special regulations for elderly, aged 57,5 years and above, allow them to remain on the earnings related UI benefit up to the official age of retirement (65 years). DI schemes are offered as a safety net for those who are physically or mentally too impaired to obtain gainful employment. DI benefits

[6] After tax, the replacement rate is substantially higher because early retirees do not pay social insurance premiums.

[7] Because of its generosity, from the mid-nineties onwards many employers (pension funds) have replaced the VUT schemes by so-called flexible early retirement schemes. These schemes are more actuarially fair than the VUT schemes and only apply for younger employees (born after 1946). For older employees (borne before 1947) the VUT schemes still apply. In this paper, we use a panel data set until 1996 which means that the VUT schemes are the only relevant ER schemes in our analysis.

[8] There is a maximum benefit level. In 1996 this was 25816 Euro.

are a function of last earned gross wages and the minimum wage. At the age of 58 a DI benefit recipient is provided with a earnings related DI benefit (70% of gross wages) up to the official age of retirement. At earlier ages, earnings related DI benefit are provided for a maximum entitlement period that depends on age. After exhaustion of earnings related DI benefits, subsequent benefits are a function of the last earned wages and the minimum wage. We refer to Appendix A for more details on the exact calculation of DI and UI benefits. A consequence of the institutional structure is that elderly workers face different retirement options. Compared to most other countries these options are very generous. At certain points in time there are clear-cut financial incentives for individuals to retire[9]. Yet, if we look at the retirement patterns of different demographic groups, there exists considerable heterogeneity. The next section documents more extensively on this.

3 Data, facts and figures

3.1 Data

We use the first 13 waves, covering 1984 to 1996, of the Dutch Social Economic Panel (SEP). 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. The aim of the SEP is to provide a description of the most important elements of individual and household welfare and to monitor changes in these elements over time. As such this survey is not specifically designed to cover retirement issues per se. Indeed some information relative to ER age and ER replacement rates are missing. This issue will be addressed using an auxiliary data set, the CERRA[10]. We will return to this in section 4. The SEP is representative of the Dutch population, but it excludes individuals living in special institutions like nursing homes. Statistics Netherlands applied a two stage sampling procedure. Firstly, municipalities are drawn with probability depending on the number of inhabitants (big cities are drawn with certainty). Next, addresses are selected randomly. All households present at the selected address are interviewed, up to a maximum of 3 households. Over the years 1984 to 1989, households were interviewed twice a year. Since 1990 the survey was held annually.

In this paper we present summary statistics of labour supply behaviour of households of which head[11] is aged 50 to 65. Next, individuals are divided into "head" and "partner" in the household. For the empirical analyses we

[9] DI and UI benefits have very high implicit tax rates at the age of 58 and 57,5, respectively. See for instance Lindeboom (1999) for calculations of implicit tax rates for UI, DI and VUT schemes.

[10] Center for Economic Research on Retirement and Aging (see Appendix A).

[11] Statistic Netherlands defines the head as the men in the household or the "main income earner" if no men is present

will drop self employed individuals and we will consider employment as a self reported information about the main activity[12], and part-time employment will not be considered. We will also make a distinction between the following marital states: married, divorced, widow, other singles (never married). In total, yearly, approximately 11.000 observations are available. We have eliminated those who did not qualify according to the age criterion, did not belong to one of the defined marital states or who had item non-response on essential variables like age, gender and employment status. The descriptive analysis will be based on 3 levels of selection of the sample. First data are presented for the repeated cross section sample in the period 1984-1996. A further selection is required for transition studies. Namely individuals have to be observed at least in two consecutive waves in the sample. This leaves us in total with information on 5671 couples and 2379 singles[13]. Finally the estimation are carried after dropping all observations before 1990, due to dramatic changes in the income questionnaire occurred after that year.

3.2 Facts and figures

We start with a description of the data exploiting the cross sectional information in our sample. Table 1 depicts patterns for labour supply for heads according to their marital status for different ages as well as for partners. For heads the drop in labour participation is not very relevant at younger ages, but this changes after age 50, when individuals become eligible to early retirement schemes like the VUT. Partners' participation is definitely the smallest among the different groups at any age.

More insight can be obtained after a closer look at the relative sizes of the different types of households and the changes in these relative sizes over time. Table 2 provides the fraction of the married, the widowed, the divorced and other singles for different age groups at different points in time. The table shows how marital status differs across cohort. Of course, older cohorts have lower marriage rates and higher rates of widowhood. What is remarkable, however, is that these fraction already start to change at relatively young ages. For instance, for the cohort 1936-1931, bereavement starts to accelerate at the ages of 64 to 70. The increased risk must have consequences for family labour supply decisions (Lumsdaine and Mitchell 2000).

The fact that the divorce rates of the younger are much higher may also have consequences. If the labour supply of the elderly has anything to do with marital status and the role played within the household, then future labour participation rates may change regardless of any policy change or intervention[14].

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[12] Some data manipulation was necessary to circumvent some major changes in the questionnaire and make different waves difficult to confront. In 1990 the question about the current employment status changed into a question about the main current activity. The individual could express different answers. We have separated the ones who reported "paid employment" from the rest (UI, DI, volunteers etc.)

[13] These number refers to the rotating panel. For the treatment of income related variables look at appendix A.

[14] In the elderly only 1.6% of the married heads do change their marital status, 0.8% to

These numbers say little about the division of labour supply within the household. Table 3 gives the participation rate of the heads, conditional on the labour force status of the partner. So, for instance, 84% of the 50 year old heads with a non- working partner are still at work, whereas 88% of the 50 year old heads with a working partner are at work. In general one can see that labour force participation rates of heads with a non-working partner are lower then the labour force participation rates of their counterpart with a working partner. Table 4 displays some more information on the labour force participation behaviour of couples over time. Only two states are considered: employed, or not (referred to as out of the labour force)[15]. This generates four possible combinations: both employed; head employed and partner out of the labour force (H_{EMP}, P_{OLF}); head out of the labour force and partner employed (H_{OLF}, P_{EMP}); both out of the labour force. The table shows that the combination (H_{OLF}, P_{EMP}) is rather rare and that it is more common that both are out of work or that the head works and the partner not.

The tables above are based on the cross-sectional information of the different waves of our survey. Although this is interesting in itself, this does not display the dynamics in the labour force participation behaviour to the full extent. Below we add some tables that may shed some more light on the labour force dynamics of different types of couples.

Figure 1 reports hazard rates of heads of households: singles heads, heads with a working partner and heads with a non-working partner consistent with the cross sectional information displayed earlier, we see that single heads have higher transition rates across almost all ages. Not much differences are observed between the transition rates of heads with a working partner and heads with a non-working partner. The sharp increase in the transition rates around the ages 59- 62, the age where most VUT schemes become effective, reveals that these schemes provide strong incentives towards retirement.

Table 5 displays family labour supply transition rates. 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 labour supply positions. About 72% of the couples where both are employed remain in the same situation after one year and of about 18% the partner stops working. It is interesting to note that it appears that when both are at work, it is more prevalent that the partner stops earlier then the head. The situation where both are out of the labour force is practically an absorbing state, as 97% of couples remain in this situation. This will prove to be important for the formulation and the empirical implementation of our model. Relatively high transition rates out of work are observed for partners with a non-working head.

Table 6 displays individual transitions for different types of households. For all groups non-work appears to be persistent. For the never married singles, for instance, only 1% of those not at work in a specific year return to work in the

divorce and 0.8% to widowhood. Partners are instead 40% more likely to become widow than to divorce, but also in their case the chance to break marriage is 1.2%.

[15] The employment status is derived from a response regarding the main activity. We don't make any distinction between full-time and part-time employment.

next year. The labour force dynamics of the partner of married couples and the widowers differs from that of the other groups. They experience higher exit rates out of employment.

To summarize this section, one can conclude that there are large differences between the behaviour 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 virtually 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.

Estimation of a formal model may help us to understand the underlying causes of the observed behaviour of the different demographic subgroups in our sample. We return to this in section 4 where we present the results and provide a Oaxaca kind of decomposition to see whether the differences are a result of differences in behaviour of the different demographic subgroups, or of the availability of retirement options below, we first present our model and the empirical implementation.

4 Theory and Empirical implementation

4.1 Theory

Family retirement is viewed as an outcome of a cooperative bargaining process where the expected present discounted value of life time family utility is maximised subject to a life time budget constraint. More specifically, define $U_t^h = U^h(l_t^h, y_t^h, l_t^p, y_t^p)$ as the per period utility flow of the head of the household at time t. U_t^h depends on his/her own income (y_t^h) and labour supply (l_t^h) and on the partner's income and the labour supply (y_t^p and l_t^p, respectively). Similarly, $U_t^p = U^p(l_t^p, y_t^p, l_t^h, y_t^h)$ can be defined as the per period utility flow of the partner. Wages are denoted by w_t^k, whereas retirement benefits are denoted by $b_t^k(R)$, $k = h, p$. In the definition of the retirement benefit, it is reflected that both the level and the time path of the benefit may depend on the time that the benefits are collected for the first time (the retirement date R). We exclude the possibility of part-time work, so l_t^k is either zero or one, $k = h, p$. Hence w_t^k refer to full-time wages and $y_t^k = w_t^k$ if $l_t^k = 1$ and $y_t^k = b_t^k(R)$, if $l_t^k = 0$, $k = h, p$. We also assume that family utility (U_t) is a weighted average of the individual utility flows, i.e. $U_t = \lambda U_t^h + (1 - \lambda)U_t^p, 0 \leq \lambda \leq 1$.

In case we assume absence of savings then the optimal path of family labour supply, $l_t^h, l_t^p, t = 0, .., \max\{T^h, T^p\}$, follows from:

$$E_t \sum_{t=0}^{T_{\max}} \rho^t U\left(l_t^h, y_t^h, l_t^p, y_t^p; \lambda\right) =$$

$$E_t\{\sum_{t=0}^{T^h} \lambda\rho^t U^h(l_t^h, y_t^h, l_t^p, y_t^p) + \sum_{t=0}^{T^p}(1-\lambda)\rho^t U^p(l_t^p, y_t^p, l_t^h, y_t^h)\} \tag{1}$$

In this expression ρ is a discount factor that is taken as common to the partner and head of the household. We implicitly substitute the wage and benefit paths associated with optimal paths of family labour supply. In this way the family (life time) budget constraint is acknowledged. Note that non-separability in the lifetime budget constraint between future consumption and current labour supply decisions, which complicates the optimisation problem, is introduced as both the level and the time path of the benefits depend on the timing of retirement. The variable $T_{\max}$ represents the planning horizon and is defined as $\max\{T^h, T^p\}$. T^h, T^p are the individual planning horizons of the head and the partner respectively. We will take the planning horizon as the number of periods remaining up to the official (mandatory) age of retirement (65). In the next subsection we will show that differences in the planning horizon of heads and partner can be used to identify the most of the underlying structural parameters of the model.

In the previous section it was concluded that retirement could be viewed as an absorbing state as there is virtually no return to work out of the non-working states. When imposed on our maximisation problem, we can make expression 1 more explicit as a problem for the choice of the optimal date of retirement for head (R^h) and the partner (R^p):

$$\underset{R^h,R^p}{Max} E_t\{\sum_{t=0}^{R^h-1} \lambda.\rho^t U^h\left(1, w_t^h, l_t^p, y_t^p\right) + \sum_{t=R^h}^{T^h} \lambda.\rho^t U^h\left(0, b_t^h(R^h), l_t^p, y_t^p\right) +$$
$$\sum_{t=0}^{R^p-1}(1-\lambda).\rho^t U^p\left(1, w_t^p, l_t^h, y_t^h\right) + \sum_{t=R^p}^{T^p}(1-\lambda).\rho^t U^p\left(0, b_t^p(R^p), l_t^h, y_t^h\right)\} \tag{2}$$

The optimisation problem for a single individual household follows directly from the case with $\lambda = 1$[16]

4.2 Empirical implementation

To allow for heterogeneity in retirement patterns, observed (X_{it}^k) and unobserved characteristics μ_{it}^kmay enter the individual utility functions of both head and partner, $U^k(l_{it}^h, y_{it}^h, l_{it}^p, y_{it}^p; X_{it}^k, \mu_{it}^k) = \overline{U}^k(l_{it}^h, y_{it}^h, l_{it}^p, y_{it}^p, X_{it}^k) + \mu_{it}^k$. We will assume that μ_{it}^k can be decomposed in a time constant individual specific

[16]The case where $\lambda = 1$ is used (implicitly or explicitly) in the larger part of the studies on individual retirement behaviour.

term π_i^k and an idiosyncratic shock ε_{it}^k, $\mu_{it}^k = \pi_i^k + \varepsilon_{it}^k$, $\pi_i^k \perp \varepsilon_{it}^k$, $k = h, p$. The time constant individual terms π_i^h and π_i^p may represent, possibly related, unobserved preferences for work of the head and partner, respectively. It is reasonable to assume that π_i^h and π_i^p are known to the individuals but not to researcher. The idiosyncratic shocks ε_i^h and ε_{it}^p are independently and identically distributed random variables. They are included to represent uncertainty regarding future retirement options or uncertainty with respect to the time path of other variables that are of relevance for the retirement decision. In line with the literature we assume that the agent knows the value of the current drawings from ε_{it}^h and ε_{it}^p, but that there is uncertainty regarding future values of these random variables.

The above implies that there is room for updating previous decisions regarding retirement and that the optimisation problem 2 can be written as a per period comparison of the value functions associated with the different alternatives. More specifically, for the situation that both family members are employed, the value of continued work for both the partner and the head, $V_t(l_t^h = 1, l_t^p = 1; \lambda) = V_t(1, 1; \lambda)$, equals:

$$V_t(1, 1; \lambda) = U\left(1, w_t^h, 1, w_t^p; \lambda\right) +$$
$$\rho E_t \max\{V_{t+1}(1, 1; \lambda), V_{t+1}(1, 0; \lambda), V_{t+1}(0, 1; \lambda), V_{t+1}(0, 0; \lambda)\} \tag{3}$$

and

$$V_t(1, 0; \lambda) = U\left(1, w_t^h, 0, b_t^p; \lambda\right) + \rho E_t \max\{V_{t+1}(1, 0; \lambda), V_{t+1}(0, 0; \lambda)\} \tag{4}$$

$$V_t(0, 1; \lambda) = U\left(0, b_t^h, 1, w_t^p; \lambda\right) + \rho E_t \max\{V_{t+1}(0, 1; \lambda), V_{t+1}(0, 0; \lambda) \tag{5}$$

$$V_t(0, 0; \lambda) = U\left(0, w_t^h, 0, b_t^p; \lambda\right) + \rho E_t \{V_{t+1}(0, 0; \lambda) \tag{6}$$

The value function associated with a specific action depends on the current per period utility associated with that action and optimal future behaviour taking uncertainty into account. Note that, in line with the absorbing state assumption, the number of elements in the $E_t max\{.\}$ terms reduce when one or more of the family members are out of work.

A family with a head and partner both at work at time t,remain in their state if $V_t(1, 1; \lambda) = \max\{V_t(1, 1; \lambda),\ V_t(1, 0; \lambda),\ V_t(0, 1; \lambda),\ V_t(0, 0; \lambda)\}$.The head stops working and the partner remains at work if $V_t(1, 0; \lambda) = \max\{V_t(1, 1; \lambda),$ $V_t(1, 0; \lambda),\ V_t(0, 1; \lambda),\ V_t(0, 0; \lambda)\}$ etc.

Finally, labour supply choices for families in different situations follow accordingly, for instance, $\max\{V_t(1,0;\lambda),\, V_t(0,0;\lambda)\}$ is of relevance for the labour supply choices of a family with a working head and a non-working partner. If ε_{it}^h and ε_{it}^p are taken as independently and identically distributed extreme value type I distributed random variables, then closed form solutions for the optimisation problem exists. For instance, if we write $V_t(.,.;\lambda) = \overline{V}_t(.,.;\lambda) + \varepsilon$, $\varepsilon \backsim EVI$, [17] then, $E_t \max\{V_{t+1}(1,1;\lambda), V_{t+1}(1,0;\lambda), V_{t+1}(0,1;\lambda), V_{t+1}(0,0;\lambda)\}$ equals: $\gamma + \ln\{\overline{V}_{t+1}(1,1;\lambda) + \overline{V}_{t+1}(1,0;\lambda) + \overline{V}_{t+1}(0,1;\lambda) + \overline{V}_{t+1}(0,0;\lambda)\}$, with γ as Euler's constant (Rust 1989) and a family with both members at work at time t will still have both members at work at time $t+1$ with probability:

$$\frac{\exp\{\overline{V}_t(1,1;\lambda)\}}{\exp\{\overline{V}_t(1,1;\lambda)\} + \exp\{\overline{V}_t(1,0;\lambda)\} + \exp\{\overline{V}_t(0,1;\lambda)\} + \exp\{\overline{V}_t(0,0;\lambda)\}} \tag{7}$$

Probabilities like these will form the basis of the likelihood function. Identification of the preference parameters in $\overline{V}_t(1,1;\lambda)$ requires us to be more explicit about the specification of the individual utility functions. For a head of the household we specify:

$$U_t^h = \alpha_{1h}^h y_{it}^h + \alpha_{2h}^h l_{it}^h + \alpha_{2p}^h l_{it}^p + \alpha_{3h}^h l_{it}^h y_{it}^h + \alpha_{3p}^h l_{it}^p y_{it}^p + \alpha_4^h y_{it} + \pi_i^h + \varepsilon_{it}^h \tag{8}$$

The utility function for the partners (U_t^p) is specified similarly, with parameters $\alpha_{jp}^p, j = 1,..,4$ and $\alpha_{mh}^p, m = 2,3$ and random variables π^p and ε_t^p. The variable $l_{ht}.y_{ht}$ is included to allow for different marginal utility of income for workers and non-workers. $l_{pt}.y_{pt}$ and l_{pt} are included to allow for a direct effect of the spouses labour supply decision. Income or consumption sharing is captured by the effect of $y_t = y_{ht} + y_{pt}$. In the empirical application we will also include a set of taste shifters X_t^k to the specification of U_t^k[18].

This specification leads to 13 parameters of interest $\alpha_{jp}^p, j = 1,..,4$ and $\alpha_{m2}^p, m = 2,3$ plus $\alpha_{jh}^h, j = 1,..,4$ and $\alpha_{mh}^h, m = 2,3$ and the bargaining parameter λ. It is not possible to identify the bargaining parameter λ separately. We can, however, with information on differences in the planning horizon, identify all the α parameters, up to a scale factor λ. Next, for $t < T_{\min} = \min\{T^p, T^h\}$, the difference between $V_t(1,1;\lambda)$ and $V_t(1,0;\lambda)$ identifies $(1-\lambda)\,\alpha_{1p}^p$, $(1-\lambda)\,\alpha_{2p}^p$, $(1-\lambda)\,\alpha_{2p}^p$. The difference between $V_t(1,1;\lambda)$ and $V_t(0,1;\lambda)$ identifies $(1-\lambda)\alpha_4^p, (1-\lambda)\,\alpha_{2h}^p$ and $(1-\lambda)\,\alpha_{3h}^p$. As such this information alone appears not be sufficient to identify all underlying parameters. Family utility is maximized over the relevant optimization period (T^h or T^p)

[17] If both ε^h and $\varepsilon^h$are independent and identically distributed as an extreme value type I distribution, then so is the weighted sum. Note furthermore that$\overline{V}_t(.,.;\lambda)$ still includes μ^h and μ^p and that these random variables need to be integrated out of the likelihood function.

[18] For now one could assume these to be included in π_i^k.

of the individual members of the family (cf 1). For the case that $T^h > T^p$, $T^p < t < T^h$changes from work to non-work identify $\lambda\alpha_{1h}^h, \lambda\alpha_{2h}^h$ and $\lambda\alpha_{3h}^h$. Similarly, for $T^h < T^p$, $T^h < t < T^p$,changes out of work identify $\lambda\alpha_4^h, \lambda\alpha_{2p}^h$ and $\lambda\alpha_{3p}^h$. Note, that implies that we can not use differences in age (planning horizon) as an additional taste shifter in the family utility function [19].

$\overline{V}_t(i,j;\lambda), i,j \in \{0,1\}$ is recursively defined and estimation of the full structural model requires calculation of these functions in each step of the optimisation procedure. This may be quite cumbersome in practical situations, even if we take retirement as an absorbing state. Fortunately, specifics of the Dutch institutions allow us to simplify the calculation of $\overline{V}_t(i,j;\lambda), i,j \in \{0,1\}$ considerably. As documented in section 2, employer provided early retirement schemes (VUT), Disability Insurance (DI) and Unemployment Insurance (UI) schemes act as competing exit routes to facilitate retirement. Previous research ((Kapteyn and de Vos 1997), (Lindeboom 1999)) showed that implicit tax rate of the VUT schemes were extremely high at the very moment that an individual becomes eligible for the VUT[20]. As a consequence, the value of continued work can be approximated by the value of working up to the age of VUT eligibility[21]. Given the above, family retirement probabilities are simple (multinomial) logits, like 7, where the (utility) value of continued work for the family members is replaced by the (utility) value of working up to the age of VUT eligibility. The preference parameters follow from straightforward maximisation of the likelihood function. Results of the model are in the next section. We first have to make a couple of additional remarks before we return to the results.

Firstly, we observe four different retirement states for a two person household (dually employed) at the initial wave of our sample. Both the head and the partner could be at work, one of them could be out of work and the other at work and both could be out of work. We view retirement as an absorbing state which makes the latter case as the least interesting[22]. Analogously, we do not use the information of non-working singles in our likelihood function. Furthermore, with respect to families where only one member is at work, the typical traditional Dutch elderly household consist of a working male and a non-working female partner. As a consequence we observe only a few households (about 150), where the partner is at work and the head (male) not. We will therefore pool these groups together in our empirical analyses, thereby allowing for some flexibility in the specification to distinguish between the two different types of households.

A natural way to deal with this kind of information in the likelihood function is to model the probability that the household is observed in a particular state

[19] Alternatively, one could exploit the differences in life expectancy of heads and partner as the source of identifying information.

[20] For UI schemes maximum implicit tax rate are obtained at the age of 58, the age where special regulations for elderly (such as prolonged benefit entitlement periods) become active.

[21] This coincides with the option value definition Stock and Wise (1990)and the peak value definition of Coile and Gruber (2000). There is some discussion about the accuracy of this approximation. We feel, however, save in this respect due to the clear cut, well defined incentives of the VUT schemes.

[22] This is supported by the data (see section 3).

at the date of selection along with the process of transitions between alternative states. We choose to condition on the labour market state that a family was observed to be in at the initial wave and estimate separate models for different types of household (i.e. a different model for two member households where both are at work, that is the dual employment case, a model for two member households where only one member is at work, that is the traditional household, and a model for singles who are at work). It is clear that we have to interpret the results, taking this conditioning into account[23].

Secondly, wage and benefit information is required to calculate the expected utility streams associated with the different retirement ages. We used the SEP sample to estimate fixed effect wage models for workers aged 50 years and older. After correction for age effect, no additional time effect remained. We therefore used the wage observed at the first wave as the individual wage measure and assumed it to be constant (in real terms) thereafter[24]. Pension at the mandatory retirement age of 65 is calculated on the basis of the observed wage and tenure and experience and are calculated for each individual in the sample. With respect to the benefit variables, the SEP data consist of a random sample from Dutch households. Therefore it is not specifically designed for the analyses of labour market behaviour of the elderly (such as for instance the HRS survey). As a consequence of this, the data set lacks specific information on the specifics of the firm specific early retirement (VUT) scheme. There exist common, fixed, rules for eligibility and replacement rates for civil servants. These are used to calculate individual benefit profiles. There is a wide range of different firms specific VUT schemes for private sector employees. In general, the terms of these schemes depend on sector, experience and occupation. We used the CERRA survey to distillate the VUT rules, like the replacement rates. Indeed we infer the distribution of ER eligibility ages and integrate age out instead of imputing it directly (see Appendix A).

5 Results

The estimation results for singles (SI), the one earner couples (OE) and the two earners couples (TE) are presented respectively in tables 8, 9 and 10. Summary statistics are in table 7. In this section we discuss these tables by showing the most relevant outcomes of our models.

[23] We feel that it is less stringent as it may appear at first. A substantial part of the elderly household is of the traditional type, where the man works and the female partner does not work and has never worked. One may argue that this is a behaviorally very distinct from the family where both male and female have a career. Furthermore, in the alternative case, where we explicitly take account of the initial condition problem, results will still depend on assumptions required to justify this approach (see for instance Heckman, Manski, and McFadden (1981)). Finally, note that it is not uncommon to follow such a procedure. Many studies condition on families where both are at work (e.g. Gustman and Steinmeier (2000), Christensen and Gupta (1994)).

[24] This is very much in line with the Dutch context, where severe wage cuts are very uncommon at the advanced ages. See appendix A.

Table 8 is organized as follows. Two models are estimated, model 1 (on the left panel) includes all the parameters described in section 4, that are pertinent for singles. In the panel on the right we report model 2. This "additive" model does not include α_3^h that refers to the effect of the non separability between current participation and future consumption. The table lists in the upper panel the taste shifters and in the lower panel the preference parameters and other variables, like the variance of the random effect.

The first interesting result is that α_3^h does not differ significantly from zero. In other words, we cannot reject the null hypothesis that within period preferences are additively separable in leisure and consumption. Therefore, we only discuss the estimation results of the "additive" model. The parameter estimate of α_1^h represents the marginal utility of income and should have a positive sign. The parameter representing the marginal utility of labour participation, α_2^h, is expected to be negative. The estimates of these parameters have the correct sign and are significant. This is a comforting result. Among the taste shifters the only effect that is significantly different from zero is gender: men are more likely to live the labour force.

Table 9 presents the results for the one earner couples (OE) and is organised in a similar way as table 8. The lower panel, however, is somewhat different because it includes 6 parameters instead of 3 as in table 8. The relation between the parameter θ_1^h and the preference parameters is as follows: $\theta_1^h = \lambda\alpha_{1h}^h + (1-\lambda)\alpha_4^p$ (the parameters θ_2^h and θ_3^h are defined in an analogous way, see table 9). The parameter γ_1^h is defined as $\gamma_1^h = \lambda\alpha_{1h}^h$ (again, the parameters γ_2^h and γ_3^h are defined in an analogous way). As already noted in section 4, the seven preference parameters α_{1h}^h,α_{2h}^h,a_{3h}^h,α_4^p,α_{2h}^p,α_{3h}^p and λ are identified up to a scale (bargaining) factor λ. The parameters with superscript "h" ("p") appear in the utility function of the head (partner) (cf. equation 8).[25] The parameter α_{1h}^h represents the head's marginal utility of his own income and α_4^p the marginal utility of household income as perceived by the partner. The parameter α_{2h}^h measures the marginal head's disutility of work whereas α_{2h}^p is the partner's utility of the head's participation. We expect that $\alpha_{1h}^h > 0$,$\alpha_{2h}^h < 0$,$\alpha_4^p > 0$,$\alpha_{2h}^p < 0$ and $0 \leq \lambda \leq 1$ and,consequently, $\theta_1^h > 0$, $\theta_2^h < 0$,$\gamma_1^h > 0$, $\gamma_2^h < 0$. Without any differences in the planning horizon, only θ_1^h,θ_2^h and θ_3^h are identified. The variation in planning horizon allows us in addition to identify the remaining parameters of the model (γ_1^h,γ_2^h,γ_3^h).

The parameter θ_3^h and γ_3^h are included to allow for non separability between leisure and income/consumption of the head. The left panel of table 9 suggests that these parameters do not differ significantly from 0. As in the case of the SI model, we therefore only discuss the estimation results of the additive model (cf. the right hand panel of table 9). The estimates of the parameters θ_1^h,θ_2^h,γ_1^h,γ_2^h have the correct sign and differ very significantly from 0. The underlying pref-

[25] In section 4 it is noted that the TE model contains 13 preference parameters and not 7 parameters as in the OE model. In the OE model, the partner is out of the labour force (OLF). Since OLF is an absorbing state, the 6 remaining preference parameters are not identified in the OE model.

erence parameters of the model can be derived (up to the scale factor) from the θ and γ parameters. For instance, an estimate of the parameter $(1-\lambda)\,\alpha_4^p$ is obtained from the difference between θ_1^h and γ_1^h and equals -0.51 (-3.70).[26] Similarly, we can calculate $(1-\lambda)\,\alpha_{2h}^p$ (0.43 (2.91)). Given the restrictions on λ (positive and smaller than one) and the prediction of the theory about marginal utility of consumption ($\alpha_4^p > 0$) than we expect $(1-\lambda)\,\alpha_4^p > 0$. Theory also predicts $\alpha_{2h}^p < 0$ and hence $(1-\lambda)\,\alpha_{2h}^p < 0$. The fact that the parameter estimates $(1-\lambda)\,\alpha_{2h}^p$ and $(1-\lambda)\,\alpha_4^p$ have the wrong signs, can be interpreted in two ways: first, $\lambda > 1$, i.e. an excessive weight of the head in the bargain process. Second, both the parameter estimates α_{2h}^p and α_4^p have the wrong sign.[27] As the preference parameters are not identified separately, we cannot discriminate between these two explanations. However, the first explanation (excessive weight of head) is most plausible given the common (traditional) family setup in the Netherlands which still prevails for elderly households. We also estimated a simplified version of model 2 (cf. table 9) by imposing the restriction that $(\gamma_1^h,\gamma_2^h,\gamma_3^h)$'=0. In this simplified model, we do not exploit the identifying information that the head and partner have a different planning horizon. In the simplified model, the estimates of the parameters θ_1^h and θ_2^h both have the correct sign and are significant. Among the taste shifters we see that the presence of dependent children increases the probability of employment, as well as the presence of a partner with intermediate education. The other taste shifters do not contribute significantly to the explanation of the labour participation decision of the head.

The estimation results of the TE model are discussed in table 10. Again, the left hand panel presents the parameter estimates of the full model in which we allow for the fact that within period preferences are not separable in consumption and labour participation. Contrary to the SI and OE model, table 10 suggests that the additive model (cf. right hand panel) is rejected against the full model. In other words, the null hypothesis that the "non separability" parameters θ_3^h,γ_3^h,θ_3^p, and γ_3^p are equal to zero, is rejected. Further analysis suggests that in both the head's and partners' utility function partner labour participation and partner income are not separable.[28].Given this, we discuss the estimation results of the full model and leave the additive model on the right hand panel as a reference.

As in table 9 (right hand panel), the parameters θ_1^h , γ_1^h ($=\lambda\alpha_{1h}^h$), γ_2^h ($=\lambda\alpha_{2h}^h$) have the correct sign. However, in table 10 the sign of θ_2^h is contrary to our expectation. The parameter estimates of θ_1^h , γ_1^h, θ_2^h, γ_2^h imply that we find a negative estimate of $(1-\lambda)\,\alpha_4^p$ (-2.87 (-3.01)) and a positive estimate of $(1-\lambda)\,\alpha_{2h}^p$ (11.17 (1.06)). It should be noted that the estimates of the parameters $\lambda\alpha_{1h}^h$, $(1-\lambda)\,\alpha_4^p$, $\lambda\alpha_{2h}^h$ and $(1-\lambda)\,\alpha_{2h}^p$ have the same signs as in the OE model. The fact that $(1-\lambda)\,\alpha_4^p$, $\lambda\alpha_{2h}^h$ have the unexpected sign, can therefore be justified in the same way as above.

[26] The number between parentheses denotes the t-value

[27] However, it might be possible that the partner derives utility from the fact that the head works ($\alpha_{2h}^p > 0$).

[28] $(1-\lambda)\alpha_{3p}^p$ and $\lambda\alpha_{3p}^h$ differ significantly from 0, whereas $(1-\lambda)\alpha_{3h}^p$and $\lambda\alpha_{3h}^h$ don't.

The parameters θ_1^p , γ_1^p, θ_2^p, , γ_2^p, , θ_3^p, and γ_3^p do not appear in the OE model but they do in the TE model. The estimates of θ_1^p , γ_1^p imply that the partner's marginal utility of her own consumption, $(1-\lambda)\,\alpha_{1p}^p$, is positive and significant (1.27 (2.53)). For the head instead the marginal utility of household consumption, $\gamma_1^p = \lambda\alpha_4^h$, is negative, which is contrary to our expectations. However, if we look at the sum $\lambda\alpha_4^h + \lambda\alpha_{1h}^h$ we obtain a positive estimate, implying an overall positive marginal utility of income. As we said before, the estimates of the parameters $\lambda\alpha_{3p}^h$ and $(1-\lambda)\alpha_{3p}^p$ differ significantly from 0. This indicates that there are some interaction effects which makes it difficult to interpret the negative estimate of $\lambda\alpha_4^h$ independently of $\lambda\alpha_{3p}^h$. Note that the sum of these two parameters is close to zero. Another interesting result is that the parameter $\lambda\alpha_{2p}^h$(the head's marginal disutility of partner's labour participation) has the expected sign and is significant. In other words, work outcomes of one member may affect preferences of the spouse directly (see also Gustman and Steinmeier (2000)and Coile (1999)).

With respect to the taste shifters, we find similar results as in the previous tables: most parameters corresponding to the taste shifters are insignificant. An exception to this remark is that ,ceteris paribus, heads with college education more likely have a partner employed and the head out of the labour force.

A comparison of the three models reveals the following

- The preference parameters of the SI model have all the expected sign.
- The results of the OE and TE model are in line with each other. Most "help" parameters θ_1^h , γ_1^h, θ_2^h , γ_2^h have the correct signs in all OE and TE model. In both models, however, the parameter estimates $(1-\lambda)\,\alpha_{2h}^p$ and $(1-\lambda)\,\alpha_4^p$ have the wrong signs. In our opinion, the most plausible explanation for this result is that the head of the household has an excessive weight in the household decision function ($\lambda > 1$) because of the common (traditional) family setup in the Netherlands which still prevails for elderly households.
- For the TE model there is an additional problem with the parameter $\lambda\alpha_4^h$. However, most relevant is the sum $(\lambda\alpha_4^h + \lambda\alpha_{1h}^h)$ which is positive. implying an overall positive marginal utility of income.

Given the above, we feel confident to use the estimation results of the models to perform some simulations in order to decompose the observed differences in retirement trends of heads of the different demographic subgroups into differences in preferences and differences in the availability and generosity of the retirement options.We report an Oaxaca decomposition (see table 11) of the hazard rate for the head of the household across the different household types[29]. The table confronts the effects of parameters and characteristics in the hazard. On the diagonal we report the average hazard rates within every model. The off diagonal figures give predictions where both the taste shifter and the

[29]Random components are set to zero for the computations in this table.

variables corresponding to the preference parameters (the 'incentive variables') are interchanged across different models. For instance, if the singles behaves like the head of a TE couple the average hazard rate would be equal to 9% instead of the observed 12%. Table 12 should be read in a similar way as table 11. However, in table 12 only the incentive variables are interchanged across household types and not the taste shifters. For instance, if the singles have the same incentives as the head of a TE couple the average hazard rate would be equal to 8% instead of the observed 12%. The results in table 11 and 12 can be summarised as follows:

- The off-diagonal figures in tables 11 and 12 are rather similar. This implies that differences in taste shifters (e.g. education) across household types) do not contribute a lot in the explanation of observed differences in retirement behaviour.
- Singles would have a stronger tendency to stay in labour force if they had the incentives (e.g. retirement options) available to the head of OE and TE couples. Likewise, OE heads would participate longer if they had the incentives available to the head of TE couples.
- Variation in preference parameters also clearly contributes to the explanation of differences in retirement behaviour of different household types

6 Summary and Conclusions

Large variations are observed in the retirement patterns of different types of households in the Netherlands. This paper focussed on the relative importance of differences in behavioural responses of the different types of households to financial incentives. We specify dynamic models for family retirement behaviour that acknowledge the institutional features of the Dutch Social Security and the pension system. We show that all model parameters are identified up to a scale factor. The models are estimated on the Dutch Socio-economic panel. Model estimates are used to decompose the observed differences in retirement trends of heads of the different demographic subgroups into differences in preferences and differences in the availability and generosity of the retirement options.

The empirical results can be summarised as follows:

- In general, we have obtained rather plausible estimation results for the most interesting parameters.
- The head of OE and TE couples might have an excessive weight in the household decision function ($\lambda > 1$) because of the common (traditional) family setup in the Netherlands which still prevails for elderly households.
- Differences in incentive variables across household types mainly contribute in the explanation of observed differences in retirement behaviour.

- Singles would have a stronger tendency to stay in labour force if they had the incentives available to the head of OE and TE couples. This is an interesting finding because it is the group that has grown more rapidly in the last decades. The descriptive statistics show that younger cohorts of individuals experience divorce more than their predecessors.
- Variation in preference parameters also clearly contributes to the explanation of differences in retirement behaviour of different household types

In the future the share of TE couples is expected to increase, because of the rise in participation of young females. This might have consequences on retirement behaviour.

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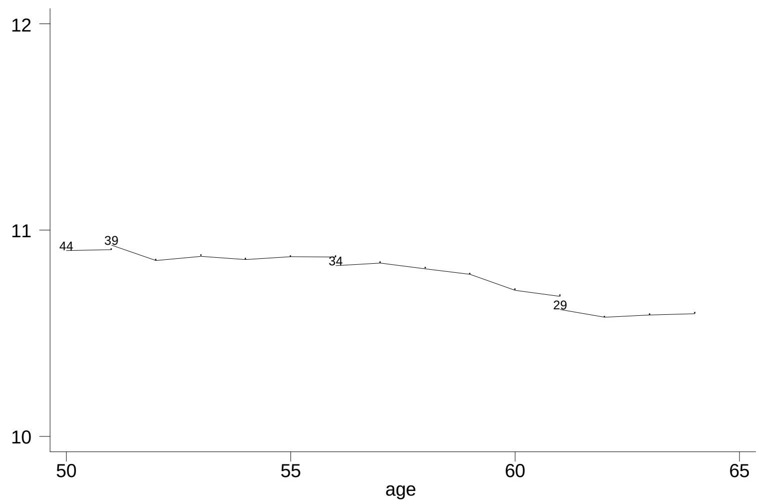
Appendix A: CERRA Data and Income Variables

Wages

As we have already stated in section 4, information about future wages and benefits is needed to calculate expected utility streams associated with different labour force participation choices. The SEP does not contain enough information to allow such a calculation. To be more precise, the following variables are not observed in the SEP: 1) future wages and benefits 2) ER eligibility age; 3) ER replacement rates. We will treat some of this missing information with an auxiliary data set, the CERRA[30].

Future wages and benefits will be considered constant at the current level in gross terms. In our computations we will add them up for any future year of employment under the assumption of individual discount rate (ρ) equal to one. Indeed the analysis of the data by cohort (see graph below) supports this assumption.

Males Wage profile over age and cohort. Period 1990-1996.



Source: SEP, own computations. 3980 observations. For every segment the average cohort year of birth is reported.

[30] The CERRA survey is a two waves survey held among about 4700 elderly households in 1993 and 1995, in which the head of the household was aged 43 to 64.

The first wave of the CERRA is representative of the Dutch Elderly population's most relevant characteristics (see Heyma (2001)). The second wave only contains the panel component, with an attrition of approximately 25% of the original sample, and is not representative of the Dutch population. That is why for our study only the wave 1993 is used. A sub sample is selected, consistently with the SEP data selection, for households in which the head (following the CBS definition) is aged between 50 and 64, and it is made up of 897 heads and 675 partners (since, when present, she is also interviewed) employed in 1993.

A fixed effect regression (carried out on age, age square and cube, tenure and its square and the interaction between age and education) shows that all age related variables are not significant. The coefficients associated to age are jointly insignificant, when applying simple test statistics. The model results are reported here below.

Table A1: Fixed effect income regression on SEP data

	coeff	t-values
Constant	-4.3230	-0.14
Age	0.7986	0.48
Age square	-0.0141	-0.48
Age cube	0.0001	0.47
Tenure	0.0098	2.84
Tenure square	-0.0002	-1.86
Age*education	0.0035	1.23
Observations	3980	
Groups	1221	
Observations per group	min	1
	avg	3.3
	max	6
R-sq	within	0.01
	between	0.20
	overall	0.18

ER eligibility and replacement rates

The computation of pension benefits in the Dutch system requires ER replacement rates and ER entitlement age. The latter is known only for civil servants. Namely the ER ages distribution in the public sector will be degenerate and concentrated at age 60 (provided 40 years of tenure or age 61 otherwise) or at age 64 if civil servants older that 61 are observed into employment.

The CERRA data contains those missing information and allows us to estimate models for ER age and replacement rates. In the remaining of this appendix we present results for both.

We estimated a logit model and an ordered logit model, for the availability of a ER scheme and the age of eligibility given entitlement, respectively (see table A2). As explanatory variables we include some individual background variables, dummy variables for sectors and experience [31]. The choice of the RHS variables is motivated by convenience[32] and based on the consideration of the most common entitlement rules to ER schemes. Next, the parameters estimates

[31] We also tried to include an occupation variable, unfortunately there was no consistent definition between the occupational codes used in the CERRA survey and the codes used in the SEP sample. We refer to Heyma (2001)for more details on the estimation of models for VUT availability and eligibility on the CERRA sample.

[32] Variables have been included only when defined in the same way in the CERRA and the SEP. Some adjustments of the data-coding was necessary to make the data on sectors

are used to calculate the probability distribution of the expected (utility) stream of working up to the age of ER eligibility[33]. Here below we report the model results for eligibility of the head[34], while a separate model, analogous to this one, is estimated for partners.

Table A2: Models for heads' eligibility with CERRA data

	Model for eligibility		Order Logit for ER age	
	coeff	t-values	coeff	t-values
Constant	0.32	0.4		
Married	0.46	0.88	-0.11	-0.30
Single	0.17	0.28	-0.2	-0.41
Divorced	1.25	1.86	-0.01	-0.02
Elementary Education	-0.10	-0.45	-0.5	-2.67
Intermediate Education	-0.17	-0.79	-0.36	-1.93
Tenure	-0.06	-7.53	0.006	0.91
Sector dummies[35]				
Industry & electricity	-1.32	-2.16	0.37	0.58
Constructions and reparations	-1.38	-2.13	-0.94	-1.40
Traditional services	-0.27	-0.42	0.68	1
Financial & technological services	-0.48	-0.77	0.78	1.15
Culture & environment	-0.87	-1.37	0.66	0.99
Number of obs	897		671	
Pseudo R2	0.11		0.03	
Log likelihood	-435.25		-1232.6	

For the distribution of different retirement ages[36] we confront in the next graph the actual frequencies observed in the CERRA and the probabilities predicted in the SEP (year 1993).

comparable since the definition changed in the SEP after year 1993. The conversion from one classification to the other was organized on seven sectors to reduce arbitrariness in the adjustments.

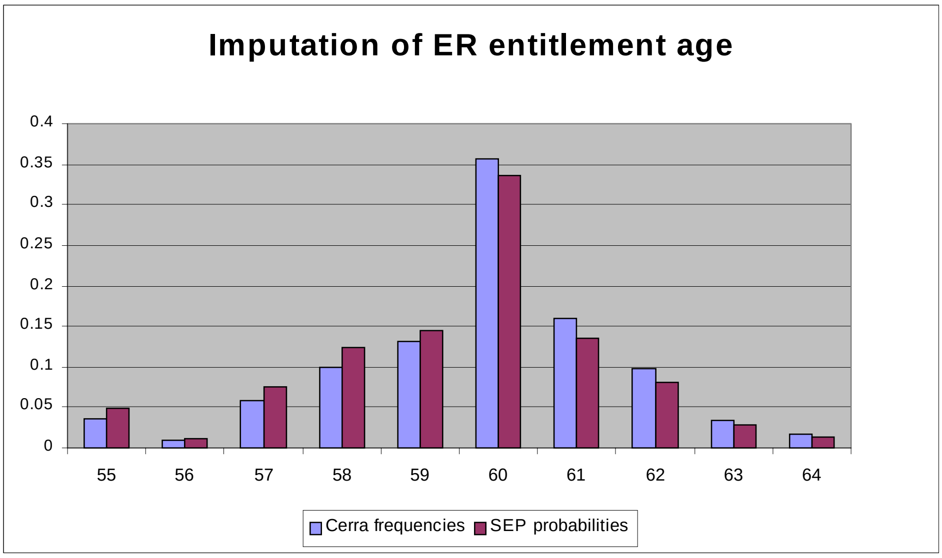
[33] This means that we calculate the utility flows associated with working up to each possible eligibility age and weight these with the associated probability that the individual is eligible.

[34] Eligibility is derived from the answer to the question : "Does the company you work for now have an early retirement scheme?"

[35] The reference case is the primary sector while the public sector is not included since rules on eligibility are known.

[36] Such distribution is derived from the question "What are the conditions you have to meet in order to take early retirement? Is the scheme only for people of a certain age and seniority or does the company only take seniority into account?"

Those declaring that there is only a specific age but did not report it, were imputed the average company age as derived by the question :"Do you know the average age of people who stop working in the company you work for? That is to say stop working because of (early) retirement." Those reporting a tenure requirement for eligibility, but with a missing value for eligibility age, are imputed as ER age the sum of the current age plus the remaining time to completed tenure.



As shown by Heyma (2001)the SEP and the CERRA data are comparable, as far as the main characteristics of the population are concerned, though the Constructions & Reparations sector (that has the lowest ER age) is rather under-represented in the CERRA.

We also use the CERRA data to impute the replacement rate according to the sector of employment[37]. Here below they are reported for gross income.

Table A3: ER replacement rates for different sectors

	Males	Females
Primary	74.7%	74.4%
Industry & electricity	75.2%	67.3%
Constructions and reparations	74.1%	74.3%
Traditional services	76.4%	73.1%
Financial & technological services	73.7%	73.2%
Government & education	73.4%	72.3%
Culture & environment	72.1%	70.7%

Benefits and pension streams

With the predicted replacement rate and income profiles we compute the present discounted value of the benefit streams. We explicitly use the formal rules of social security[38] as summarized in section 2.

[37] The gross replacement rate is derived from the question: "Do you know what percentage of your last net or gross wages would be paid out, if you (could) take early retirement?"

[38] It differs slightly for the social insurance, since we assume that the accumulation of pension rights stops if individuals stop with work before ER eligibility. In case of ER the future accumulation of pension years is 100% (though this is not the case for all ER schemes in the Netherlands).

For those stopping with work before eligibility to ER, we compute a UI benefit at 70% of the last observed wage up to a ceiling[39]. Such benefit lasts for an eligibility period of maximum five years depending on experience if individuals are younger than 57,5. For instance a worker with 10 years of experience or less, will expect a maximum entitlement of 1 year. Afterwards he will receive social assistance amounting to 70% of the minimum wage. In reality the minimum wage varies over time but we have kept it constant for the future to the current level as we did for income. For those older than 57,5 the UI benefit is kept constant till age 65 when AOW, plus the occupational pension, will replace it. In our computation we do not make a distinction between DI and UI benefits[40].

After age 64 the formula used for the occupational pension features an accrual rate of 1.75% for a maximum of 40 pension years and a free amount depending on marital status. The proxy used for pension years is experience[41]. Actually the computation of the occupational pension follows closely the rules of the largest Dutch pension fund (ABP) that covers all civil servants. Different values of the occupational pension are relevant to this study, namely the one transferred to individuals that keep on accumulating pension rights till age 64, and the one computable at the moment of the observed transition OLF (the first being larger than the second). This implies a simplification of the existing rules, since UI in many cases allows a partial accumulation of pension rights, typically for a few months. This possibility is here not taken into account.

Implementation of ER eligibility in the model

As stated above we do not observe eligibility age of ER schemes in the private sector but the probability distribution of it. In the remaining of this appendix we will show how we are able to integrate out of the log likelihood the unknown ER eligibility age, and the replacement rates, using their distributions. Define the random variable e as the year in which someone becomes eligible to ER. Given the incentive structure (se sections 2 and 3), that leads people into ER as soon as they become eligible for a VUT scheme, the following holds: $l_0 = 1 \Leftrightarrow e > 0$ (i.e. if a person works, that is $l_0 = 1$, he is not yet eligible for ER at time zero, or before; $e > 0$).

For example, we may observe the head of the household working at age 57. For this individual we have imputed a probability distribution for e in the SEP. This associates a probability of becoming eligible to any age between 55 and 64. We will treat this individual as if he was not eligible at age 55 and 56. So the probability of becoming eligible at age 57 will be conditioned on the sum of the probabilities at age 55 and 56.

The **value of continued work** will result from the probabilistic combination of salary $(w^k, k = h, p)$ and early retirement benefit $(VUT^k, k = h, p)$.

[39] For year 1990 it amounted to about 31700 EUR, increasing over time.

[40] A distinction would complicate the model considerably. Furthermore there are little differences in the benefit levels of UI and DI.

[41] This is derived from a question about the amount of years in full time or part-time employment over the whole life of the respondent. Furthermore possible losses due to changes of job and pension funds in previous years have not been taken into account.

This means that for any individual $k = h, p$, following the notation of section 3, the following will hold:

$$E\left(y_{kt}|l_{k0}=1\right) = \Pr\left(e_k \leq t|e_k > 0\right) * VUT^k + \left(1 - \Pr\left(e_k \leq t|e_k > 0\right)\right) * w^k$$

if $0 < t \leq T^k$ and

$$E\left(y_{kt}|l_{k0}=1\right) = pens$$

if $t > T^k$. The $\Pr\left(e_k \leq t|e_k > 0\right)$ is the probability of eligibility[42] and $pens$ is the total pension computed summing up AOW and an occupational pension with "partially" incomplete tenure, since the years between 0 and T^k are added up pre multiplied by a certain probability.

The value of stopping with work immediately will result from the combination of a UI benefit ($WW_t^k, k = h, p$), and eventually social assistance[43], combined with a VUT.

$$E\left(y_{kt}|l_{k0}=0\right) = \Pr\left(e_k \leq t|e_k \geq 0\right) * VUT^k + \left(1 - \Pr\left(e_k \leq t|e_k \geq 0\right)\right) * WW_t^k$$

if $0 < t \leq T^k$ and

$$E\left(y_{kt}|l_{k0}=0\right) = pens^*$$

if $t > T^k$.

The pension benefit $pens^*$ is computed on incomplete careers since the years between the decision to stop working and age 64 are not considered in the computation of the occupational pension (while the decision to retire earlier does not affect the old age benefit AOW as stated in section 2).

Labour participation after eligibility will be treated as:

$$E\left(l_{kt}|l_{k0}=1\right) = l_{k0}$$

if $t = 0$;

$$E\left(l_{kt}|l_{k0}=1\right) = 1 - \Pr\left(e_k \leq t|e_k > 0\right)$$

if $0 < t \leq T^k$ and $E\left(l_{kt}|l_{k0}=1\right) = 0$ otherwise.

The interrelation between leisure and consumption will be computed as,

$$E\left(l_{kt}y_{kt}|l_{k0}=1\right) = w_{k0}$$

if $t = 0$;

$$E\left(l_{kt}y_{kt}|l_{k0}=1\right) = \left(1 - \Pr\left(e_k \leq t|e_k > 0\right)\right) * w_{k0}$$

if $0 < t \leq T^k$ and $E\left(l_{kt}y_{kt}|l_{k0}=1\right) = 0$ otherwise.

[42] For heads (partners) younger than 55 (57) the probability distribution can be used as imputed without computing any conditional probability.

[43] Moreover it is not possible to switch from ER to UI or vice versa and the benefits stream is kept constant for the future at the current level (as it is for wages). The only exception is done for UI benefits, that drop from 70% of the last observed wage to 70% of the statutory minimum wage after the variable, experience-dependent entitlement period (see Appendix A).

Figures and Tables

Table 1. Labour participation over age for different marital states.

Age	Married heads	Divorced	Widow	Never Married	Partners
50	86%	60%	58%	57%	32%
51	83%	57%	37%	55%	28%
52	82%	52%	37%	58%	24%
53	78%	44%	45%	65%	22%
54	78%	51%	41%	69%	20%
55	71%	41%	37%	70%	19%
56	68%	33%	32%	55%	17%
57	60%	33%	25%	48%	14%
58	52%	28%	25%	51%	14%
59	42%	28%	18%	45%	11%
60	27%	15%	10%	22%	8%
61	18%	8%	8%	9%	4%
62	12%	7%	4%	10%	4%
63	12%	6%	4%	11%	4%
64	10%	3%	4%	14%	2%
Observations	8506	1261	1379	842	8506

Table 1: All households with head aged 50 to 64. Repeated cross sections 1984-1996. Source: SEP, own computations.

Table 2. Marital Status over time per cohort, selected years										
Year of	Married		(Obs=8512)			Divorced		(Obs=1261)		
birth	1984	1987	1990	1993	1996	1984	1987	1990	1993	1996
1946-1942				76%	75%				13%	14%
1941-1937		67%	80%	75%	71%		22%	14%	13%	14%
1936-1932	78%	79%	73%	69%	64%	10%	9%	10%	11%	14%
1931-1927	72%	67%	63%	64%		9%	9%	9%	9%	
1926-1922	73%	68%	67%			5%	8%	6%		
<1921	67%					5%				
Year of	Widow		(Obs=1379)			Singles		(Obs=842)		
birth	1984	1987	1990	1993	1996	1984	1987	1990	1993	1996
1946-1942				4%	4%				7%	6%
1941-1937		8%	3%	6%	10%		3%	3%	6%	6%
1936-1932	6%	7%	10%	11%	14%	7%	6%	7%	9%	8%
1931-1927	11%	17%	19%	19%		7%	7%	9%	9%	
1926-1922	15%	18%	22%			7%	7%	4%		
<1921	23%					6%				

Table 2: All households with head aged 50 to 64. Repeated cross sections period 1984-1996. Source: SEP, own computations.

Table 3. Head Labour participation conditional on partner participation		
Age of the head	If partner employed	If partner out of the labour force
50	88%	84%
51	86%	82%
52	87%	80%
53	84%	75%
54	84%	76%
55	79%	68%
56	75%	65%
57	63%	60%
58	53%	52%
59	48%	40%
60	41%	25%
61	31%	16%
62	20%	11%
63	19%	12%
64	21%	9%
Observations	1800	6712

Table 3: Source: SEP, own computations. Repeated cross sections, years 1984 to 1996.

Table 4. Joint participation over time					
	Both Employed	Head employed Partner OLF	Head OLF Partner employed	Both out of the labour force	Obs
1984	18%	44%	6%	32%	598
1985	16%	41%	7%	36%	657
1986	19%	40%	6%	35%	787
1987	12%	39%	7%	42%	549
1988	16%	36%	8%	40%	557
1989	16%	36%	8%	40%	603
1990	10%	39%	6%	45%	680
1991	14%	40%	5%	41%	650
1992	12%	39%	6%	43%	694
1993	15%	38%	4%	43%	675
1994	13%	39%	5%	43%	681
1995	15%	39%	7%	40%	679
1996	17%	38%	6%	38%	702
Obs	1271	3322	529	3390	8512

Table 4: OLF = out of the labour force, obs = observations. Repeated cross sections, years 1984 to 1996. Source: SEP, own computations.

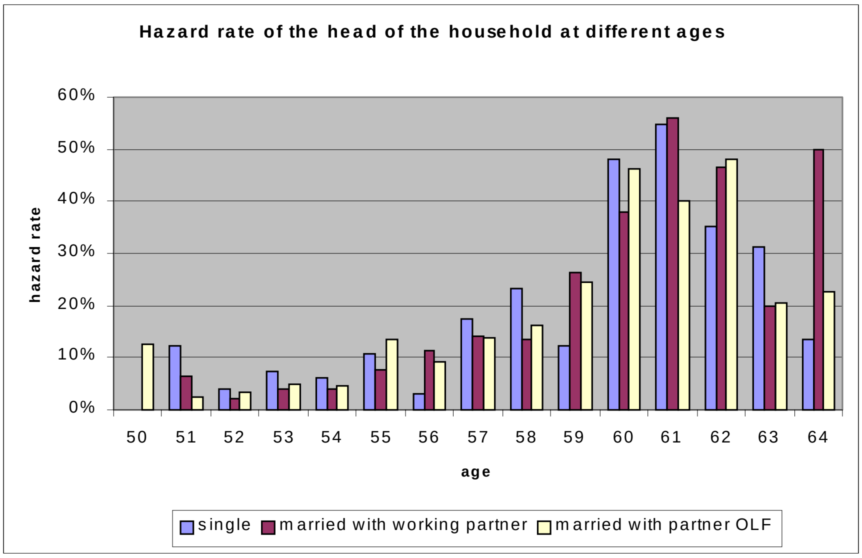


Figure 1: Source: SEP, own computations.

Table 5. Transition rates through household labour participation states.				
	Original labour market status of couples			
Labour market status after one year	Both Employed	Head employed partner not	Partner Employed head not	Both out of the labour force
Both Employed	72%	4%	4%	-
H_{Emp} P_{OLF}	18%	82%	2%	2%
H_{OLF} P_{Emp}	8%	-	74%	1%
Both OLF	3%	13%	20%	97%
Observations	700	2048	358	2565

Table 5: H = head. P = partner. Emp= employed. OLF= out of the labour force. Rotating panel period 1984-1996. Source: SEP, own computations.

Table 6. Transition rates of individual household members.										
	Original labour market status of the household members									
Labour market status	married head		partner		divorced		widow		non married	
after one year	Emp	OLF	Emp	OLF	Emp	OLF	Emp	OLF	Emp	OLF
Employed	88%	2%	79%	3%	88%	2%	73%	4%	90%	1%
OLF	12%	98%	21%	97%	12%	98%	28%	96%	10%	99%
Observations	3071	2600	1166	4505	118	188	40	80	116	154

Table 6: Emp= employed. OLF= out of the labour force. obs = observations. Rotating Panel period 1984-1996. Source: SEP, own computations.

Table 7: Descriptive statistics: mean values			
	SI	OE	TE
Labour Participation	0.88	0.86	1.38
Taste Shifters			
Dummy 91	0.12	0.16	0.13
Dummy 92	0.16	0.17	0.15
Dummy 93	0.18	0.17	0.18
Dummy 94	0.17	0.14	0.17
Dummy 95	0.16	0.16	0.16
Dummy 96	0.21	0.19	0.22
Dependent children	0.28	0.75	0.72
Elementary education head	0.39	0.35	0.26
Intermediate education head	0.30	0.41	0.43
College education head	0.31	0.23	0.31
Elementary education partner		0.23	0.13
Intermediate education partner		0.26	0.20
College education partner		0.33	0.35
Observations	428	1495	416

Table 7: SI= singles, OE= one earner, TE= two earners. Labour participation is 1 for employed and 0 for out of the labour force, for SI and OE. For TE labour participation is 1 for both employed, 2 when only the head works and 3 vice versa. Source: SEP, own computations.

Table 8. Estimation Results for Singles				
	Model 1		Model 2	
	Estim.	t-values	Estim.	t-values
Constant	1.71	2.17	1.72	2.15
Taste Shifters				
Dummy 92	-0.60	-0.95	-0.63	-0.99
Dummy 93	0.019	0.029	0.02	0.03
Dummy 94	-0.24	-0.37	-0.26	-0.4
Dummy 95	-0.46	-0.73	-0.48	-0.76
Dummy 96	-0.34	-0.52	-0.36	-0.55
Male	-0.87	-2.17	-0.84	-2.12
Divorced	0.73	1.64	0.74	1.63
Single	0.52	1.11	0.53	1.13
Intermediate education	-0.008	-0.02	-0.01	-0.02
College education	-0.58	-1.24	-0.55	-1.2
Dependent children	0.09	0.28	0.09	0.27
Preference Parameters				
α_1^h	0.32	3.24	0.34	3.8
α_2^h	-0.37	-0.88	-0.14	-2.10
α_3^h	0.023	0.54		
σ_π^2	0.07	0.07	0.09	0.08
Log Likelihood	-131.3		-131.5	
Observations	428		428	

Table 8: Reference case: out of the labour force. The two models differ because of the non separability preference parameter. For the time dummies the reference case is year 1991. For the marital status the reference case is widowhood. For education the reference case is elementary education. Simulated maximum likelihood with 75 random draws. The random effect has variance sigma square. Source: SEP, own computations.

Table 9. Estimation results for One Earner couples				
	Model 1		Model 2	
	Estim.	t-values	Estim.	t-values
Constant	0.85	3.16	0.86	3.20
Taste Shifters				
Dummy 92	-0.34	-1.20	-0.34	-1.20
Dummy 93	-0.10	-0.32	-0.09	-0.31
Dummy 94	-0.48	-1.60	-0.48	-1.60
Dummy 95	-0.48	-1.63	-0.46	-1.55
Dummy 96	-0.07	-0.23	-0.06	-0.20
Dependent children	0.35	3.17	0.35	3.19
Intermediate education head	0.18	0.87	0.17	0.84
College education head	-0.36	-1.59	-0.36	-1.65
Intermediate education partner	0.43	2.07	0.44	2.10
College education partner	0.16	0.73	0.15	0.70
Preference Parameters				
$\theta_1^h = \lambda\alpha_{1h}^h + (1-\lambda)\,\alpha_4^p$	0.26	6.80	0.26	8.30
$\theta_2^h = \lambda\alpha_{2h}^h + (1-\lambda)\,\alpha_{2h}^p$	-0.11	-0.50	-0.14	-4.10
$\theta_3^h = \lambda\alpha_{3h}^h + (1-\lambda)\,\alpha_{3h}^p$	-0.02	-0.10		
$\gamma_1^h = \lambda\alpha_{1h}^h$	0.80	5.60	0.77	5.80
$\gamma_2^h = \lambda\alpha_{2h}^h$	1.12	0.60	-0.57	-3.90
$\gamma_3^h = \lambda\alpha_{3h}^h$	-0.16	-0.90		
σ_π^2	0.001	0.04	0.002	0.05
Log Lik	-480.1		-480.6	
Observations	1495		1495	

Table 9: Reference case : out of the labour force. For the time dummies the reference case is year 1991. For education the reference case is elementary education. Simulated maximum likelihood with 150 random draws. The random effect has variance sigma square. Source: SEP, own computations.

Table 10. Estimation results for two earners couples								
	Head employed partner not		Partner empl-oyed head not		Head employed partner not		Partner empl-oyed head not	
	Estim.	t-value	Estim.	t-value	Estim.	t-value	Estim.	t-value
Constant	0.10	0.13	-2.21	-1.95	0.19	0.25	-2.7	-1.4
Taste Shifters								
Year 92	-0.18	-0.34	0.31	0.40	-0.18	-0.36	0.29	0.31
Year 93	-0.42	-0.82	-0.53	-0.68	-0.47	-0.96	-0.29	-0.33
Year 94	0.45	0.92	0.03	0.03	0.29	0.62	0.27	0.30
Year 95	0.09	0.16	0.95	1.31	-0.13	-0.25	1.3	1.33
Year 96	0.00	0.00	-0.70	-0.84	-0.15	-0.32	-0.61	-0.62
Intermediate edu. head	-0.33	-0.78	0.08	0.12	-0.34	-0.81	0.30	0.35
College education head	-0.81	-1.72	2.01	2.29	-0.84	-1.81	2.5	1.6
Intermediate edu. partner	0.20	0.47	0.50	0.63	0.17	0.41	0.38	0.42
College education partner	0.64	1.41	1.08	1.24	0.62	1.4	1.02	0.93
Preference Parameters	Estim.		t-value		Estim.		t-value	
$\theta_1^h = \lambda\alpha_{1h}^h + (1-\lambda)\,\alpha_4^p$	0.46		3.35		0.25		1.8	
$\theta_2^h = \lambda\alpha_{2h}^h + (1-\lambda)\,\alpha_{2h}^p$	2.21		2.27		-0.196		-1.24	
$\theta_3^h = \lambda\alpha_{3h}^h + (1-\lambda)\,\alpha_{3h}^p$	-0.24		-2.44					
$\gamma_1^h = \lambda\alpha_{1h}^h$	3.33		3.49		3.14		2.88	
$\gamma_2^h = \lambda\alpha_{2h}^h$	-8.94		-0.86		-2.06		-2.37	
$\gamma_3^h = \lambda\alpha_{3h}^h$	0.65		0.68					
$\theta_1^p = \lambda\alpha_4^h + (1-\lambda)\,\alpha_{1p}^p$	0.12		2.77		0.11		2.73	
$\theta_2^p = \lambda\alpha_{2p}^h + (1-\lambda)\,\alpha_{2p}^p$	0.10		0.81		0.02		0.51	
$\theta_3^p = \lambda\alpha_{3p}^h + (1-\lambda)\,\alpha_{3p}^p$	-0.007		-0.69					
$\gamma_1^p = \lambda\alpha_4^h$	-1.14		-2.29		-0.16		-2.3	
$\gamma_2^p = \lambda\alpha_{2p}^h$	-10.42		-1.99		0.03		0.39	
$\gamma_3^p = \lambda\alpha_{3p}^h$	1.07		1.98					
$\sigma_{\pi 1,1}^2$	0.08		0.24		0.014		0.09	
$\sigma_{\pi 2,1}$	0.001		0.001		-0.29		-0.41	
$\sigma_{\pi 2,2}^2$	0.18		0.22		1.8		0.4	
Log Likelihood	-237.82				-243.7			
Observations	416				416			

Table 10: Reference case: both employed. Fro the time dummies the reference case is year 1991. For education the reference case is elementary education. Simulated maximum likelihood with 75 random draws. The random effect has variance sigma square. Decomposition by delta method. Source: SEP, own computations.

Table 11. Oaxaca decomposition of the hazard rate of the head of the household.			
	Parameters SI	Parameters OE	Parameters TE
Characteristics SI	12%		
Characteristics OE	10%	14%	
Characteristics TE	9%	10%	10%

Table 11: SI= singles; OE= traditional earners household; TE=Dual Earner. The sample means of the marital status dummies for the SI model are used in the off diagonal hazards. Source: SEP, own computations.

Table 12. Oaxaca decomposition of the hazard rate of the head of the household.			
	Parameters and taste shifters SI	Parameters and taste shifters OE	Parameters and taste shifters TE
Incentive variables SI	12%		
Incentive variables OE	10%	14%	
Incentive variables TE	8%	9%	10%

Table 12: SI= singles; OE= traditional earners household; TE=Dual Earner. The sample means of the marital status dummies for the SI model are used in the off diagonal hazards. Source: SEP, own computations.