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Early Retirement

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Early retirement:
The impact of changes in the benefit level

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1. Introduction

The Netherlands is characterized by very low labor force participation of persons aged 55 and over. From OECD (1998) it appears that men in the age group of 55 to 59 years have – together with Finland – the lowest participation rates. For the age group 60 tot 64 years men show the smallest but one participation rate. Only in France, participation is even lower. For women the participation rate is the lowest in both age categories. In view of the aging of the population and the increase in the demand for labor, this development is a subject of constant concern. Two important causes for these low participation rates are the high disability rates and the huge participation in early retirement schemes. Here we focus on the latter. The original early retirement schemes in the Netherlands (indicated by VUT) result in benefit of 80% of last wages and most employees were eligible for this scheme from the age of 60, sometimes even 59 or 58 years.[1] As the benefit is independent of the age of early retirement, the VUT shows large disincentives to work. The net implicit tax rate amounts to over 80%. As a consequence, over 80% of those who are eligible for the VUT make use of it and the larger part of this group makes use of it soon as possible. It appears to be an offer that cannot be refused (Lindeboom, 1998: 10). This was where they were made for in the second half of the 1970s. Huge youth unemployment and low creation of new jobs characterize this period. In order to create jobs for young people, the VUT-schemes were established. For that reason they contained strong incentives for elderly to leave jobs. For firms it was also a cheap tool to diminish the number of employees during the economic recession, cheaper and easier than lay-off of employees. However, times have changed and the participation in the VUT is higher than desired nowadays. Also due to the resulting high costs we observe a transition from the VUT to early retirement schemes that are characterized by higher degrees of actuarial fairness.[2]

Here, we want to analyze the impact of the transition on future participation. As these new schemes are only at work since a limited number of years, it is still unsure what the

[1] Another eligibility condition refers to the number of years one has been working in the firm or sector. In general, job tenure of ten years was required. The benefit has been financed on the basis of the PAYG-system.

[2] Their financing mostly is (partially) based on funding.

implications of this transition are for the participation rates. Earlier research in the Netherlands focuses on the VUT-schemes. However, as replacement ratios hardly differ among the existing schemes, this ratio does not have a significant impact; see e.g. Lindeboom (1998) who uses data for 1993 and 1995. The situation changed since then, but a useable data set with sufficient information with respect to the use of the new schemes is not present for the time being. Recent research emphasizes that financial incentives really do play a role; see e.g. Börsch-Supan (2000) and the contribution in Gruber and Wise (1999). But, it should also be noticed that the marginal effects are often quite limited. Calculations on the basis of Börsch-Supan (2000, figure 8) show that a transition to an actuarial fair pension system in Germany raises the average age at retirement by only 0.45 years. However, the current German pension system shows a larger degree of actuarial fairness than the current Dutch one. So, the impact of change sin the Dutch early retirement system will probably be considerably larger. In order to get information on early retirement behavior in the future we conducted a survey via Internet among people 45 to 64 years of age. On the basis of this information a mixed-logit model has been estimated that gives us the probability that one retires at a certain age. From the analysis it appears that the transition from the VUT to more actuarial fair early retirement schemes will result in an increase of the participation rate among the group aged 55 to 64 years by 5 to 10 percentage-points in the next decade and even more in the long run. Another major finding is that besides the discounted value of the income sources, the number of years for which pension claims have been built up has an independent impact on the retirement decision.

This paper proceeds as follows. Section 2 shows the features of the retirement choices that have been presented to the respondents and discusses some data. Section 3 describes the empirical strategy. In section 4 the estimation results have been presented. These are used in section 5 to simulate future participation rates. At last, section 6 concludes.

2. The retirement choice models presented to the respondents

Among other things, three types of (early) retirement schemes have been presented to the respondents. These are called: VUT-scheme, pre-pension scheme and flexible pension scheme. We will successively describe them.

The VUT scheme is meant to be representative for the early retirement schemes that originate in 1976 and for the larger part still are at work. Here, respondents can choose to make use of the VUT scheme from the age 60 up to and including 64 years of age. Independent from the age, on which they participate in the VUT scheme, the benefit amounts to 80% of their final wages. Besides, the building up of occupational pension claims that result in a benefit from the age of 65 years old – if applicable - continues during the VUT. From the age of 65 one compulsorily retires and receives a basic pension and (possibly) the occupational pension benefit. In case of full coverage, the occupational pension benefit equals 70% of final wages (adjusted for the basic pension AOW).[3]

=== about here table 1 ==

The pre-pension scheme allows employees to make use of it from the age of 55 up to and including 64 years. From the age of 65 one again compulsorily retires and receives a basic pension and (possibly) the occupational pension benefit. Now the benefit depends on the age of retirement and also pension claims after the compulsory retirement age of 65 years are affected. The benefit scheme has been shown in table 1. The level of the pension from the age of 65 again refers to the pension including the AOW-benefit.

The flexible pension scheme makes it possible to retire from the age of 61 years. In contrast to the foregoing schemes, it is possible to work after the age of 65. Now, 70 years is the compulsory retirement age. Comparable to the pre-pension scheme, the

[3] Full coverage is reached when during 40 years contribution has been paid. Generally one receives an AOW benefit (the state pension) and supplementary to this the occupational pension. Together they form 70% of last earnings in case of full coverage. However, in practice the AOW benefit is often lower than the amount that pension funds take into account. This, in particular, holds for couples.

benefit depends on the age of retirement. However, there does not exist anymore a difference in the benefit before and after the age of 65 years; see table 1.[4]

The resulting average implicit tax rates have been given in table 2. The implicit tax rate has been defined as the change in the expected present value of the pension benefits (as a proportion of the annual wage) of working another year. The VUT scheme shows very high implicit tax rates: they amount to about 80% for all ages. This implies that working one year longer hardly pays. The pre-pension scheme promotes continuing to work up to the age of 59 years old. Until that age, the implicit tax rate is negative. Thereafter, it becomes positive, but is considerably below the level for the VUT-scheme. Even lower implicit tax rates hold for the flexible pension scheme up to the age of 65. The high implicit tax rate from the age of 66 years is due to the requirement that pension income is not allowed to be higher than the full-time wage income.

== about here table 2 ==

For all three types of schemes two types of questions have been asked. First, all respondents are asked at which age they would like to retire under the assumption of full coverage. Next, it is asked to decide to choose between (early) retirement at a specific age and work on until the compulsory age (65 years of age for the VUT and pre-pension scheme and 70 years of age for the flexible pension scheme) for all three schemes. The last question has been asked for the age of 60 and 62 to one half of the respondents and for the age of 61 and 63 to the other half of the respondents with respect to the VUT scheme. Under the pre-pension scheme one third had to answer the same question for the ages of 55, 58, 61 and 62 years of age; one third for the ages of 56, 59, 62 and 63 years of age and one third for the ages of 57, 70, 63 and 64 years of age. And under the flexible pension scheme one third had to answer the same question for the ages of 61, 64 and 67 years of age; one third for the ages of 62, 65 and 68 years of age and one third for the ages of 63, 66 and 69 years of age. The binary choice question has been asked under the

[4] We do not distinguish anymore between basic and occupational pension. In case of partial pension coverage, the basic pension is lowered to the same extent as for the occupational pension holds.

assumption of full pension coverage and partial (7/8 and 11/16) coverage. So, we have three answers to the first type of question and 27 answers with respect to the second type of question for each respondent (ignoring partial non-response).

The survey has been held by CentERdata, that approached 600 persons 45 to 64 years of age who regularly fill in questionnaires by Internet. Of this group, 398 persons responded, of which 28 partially. The distribution of the preferred age of retirement on the basis of the first type of question has been shown in table 3. Remember that this situation refers to full pension coverage.

== about here table 3 ==

The average preferred age at retirement amounts to 61.10 years. In spite of the fact that retirement in the pre-pension scheme has been allowed from the age of 55 years, the lower benefits up to the age of 63 years and higher benefits, the later one retires, result in an average preferred age at retirement of 61.99 years. The latter in combination with an increase in the first possible age at which one is allowed to retire increases the average preferred age at retirement further under the flexible pension scheme. This preferred age now becomes 62.83 years. Details with respect to the second type of question can be found in Nelissen (2001).

3. The estimation strategy

The choice of the age of retirement is an intertemporal decision problem. The chosen age of retirement *r* generally does not only affect the income at age *r*, but also income at all subsequent ages up to the last year of life *T*. We assume that the retirement decision has been based among other things on the expected discounted value of utility from income belonging to the alternative retirement ages. This discounted value can be expressed as follows. Let $V_t(R)$ be the expected discounted value of utility from income at age *t* if the concerning person retires at age *R*. Then (see e.g. Börsch-Supan, 1992):

$$(1) \qquad V_t(R) = E_t[\sum_{s=t,R-1} u(Y^L)\, a_s\, \delta^{s-t} + \alpha \sum_{s=R,T} u(Y_s^R(R, Y^L))\, a_s\, \delta^{s-t}]$$

with

Y^L	labor income at age s = t, ... , R-1
$Y_s^R(R, Y^L)$	pension income after retirement, s = R, ... , T
R	age of retirement
a_s	probability to survive at least until age s
α	marginal utility of leisure
δ	discount rate
T	maximum reachable age
E_t	expectation at age t

Actually, we would like to express the foregoing in terms of utility of consumption. However, we do not have data on the savngs decision. So, we ignore savings and therefore we can use income in stead of consumption in equation (1). We state the following utility function *u*:

(2) $u(Y) = Y^{\sigma}$

Here σ is a transformation of the substitution elasticity in de common constant relative risk aversion utility function. In (1) this pension income has been weighted by $\alpha>1$. The idea behind this is that labor income implies giving up leisure time. The reciproce $1/\alpha$ can be considered as the marginal disutility of work. The pension income Y^R depends on the age of retirement and for sake of simplicity we assume that labor income Y^L has not been affected by time *s*. The first type of question, whereby the respondent is asked to choose from a scala of possible retirement ages, implies that s/he has to choose from uit *J>2* alternatives. In view of the benefit structure en the presence of α, $V_t(r)$ does not need to increase monotonically. In other words, the $V_t(r)$'s are not necessarily ordered. Therefore we have to apply unordered multiple choice models (see for example, Judge, et al., 1985, chapter 18 and Greene, 1997, chapter 19). For each alternative it holds that there is a probability to choose that specific alternative. Let y_{ij} be a binary variable that takes the

value 1 when individual *i* chooses alternative *j* (*j*=1, ... , *J*), and 0 otherwise. Each individual *i* has a probability P_{ij} to choose alternative *j* (in our case a certain retirement age) from *J* possible alternatives. So, $P_{ij} = \Pr[y_{ij}=1]$. Then it holds:

(3) $\sum_{j=1,J} y_{ij} = \sum_{j=1,J} P_{ij} = 1$

These probabilities depend on the characteristics of the alternatives, the attributes (like the discounted value of the income streams that belong to the various alternatives), but will also be dependent on individual characteristics (like age, income, sex). Besides, random errors will be of influence. We therefore introduce U_{ij} which is the utility for individual *i* from alternative *j*, which can be written as:

(4) $U_{ij} = \bar{U}_{ij} + e_{ij} = x'_{ij} .\beta_i + e_{ij}$

The probability that alternative 1 has been choosen (P_{i1}) is:

(5) $P_{i1} = \Pr[U_{i1} > U_{i2} \cap U_{i1} > U_{i3} \cap ... \cap U_{i1} > U_{iJ}]$

Eq. (5) says that that probability equals de probability that the utility derived from alternative 1 is larger than the utility derived from alternative 2, but is also larger than the utility derived from alternative 3, and so on. The usual specification is the logit model. In the conditional logit model it is assumed that the error terms e_{ij} in Eq. (4) are independently and identically distributed with Weibull density functions. The corresponding cumulative density functions have the following form:

(6) $\Pr(e_{ij} \leq \varepsilon) = \exp[-\exp(-\varepsilon)]$

The probabilities on the basis of this model are given by:

(7) $P_{ij} = \exp(x'_{ij} .\beta) / \sum_{j=1,J} \exp(x'_{ij} .\beta)$

The coefficients β do not vary over the various alternatives (as is the case for the multinomial logit model). However, they may vary over individuals. The odds ratio P_j / P_k is in the standard multinomial model independent from other choices (independence of irrelevant alternatives). This possibly is a problem when considering the effects of an added alternative. This problem vanishes when we apply the what is called mixed logit model (or random parameters logit model); see for example Revelt and Train (1998).[5] Actually, this is a standard conditional logit model with coefficients that vary over the population. In general terms, the vector of coefficients for individual n (β_n) can be expressed as $\beta_n = b + \eta_n$, with b the average over the population and η_n the stochastic deviation that represent the preferences of individual n compared to the average preferences in the whole population. In contrast with the standard logit model, the stochastic part of the utility function ($x'_{nj} \,.\, \eta_n + e_{nj}$) now generally is correlated with the alternatives and en choice options as a consequence of the influence of η_n. Due to this, the problem of 'independence of irrelevant alternatives' does not play a role anymore. Besides, we are now able to explicitly make use of the panel nature of our set of observations. The mixed logit model results in efficient estimators. The estimation procedure has been given in Revelt and Train (1998, pp. 647-649).[6] In order to apply this estimation procedure we assume that the discount rate δ amounts to 0.95 and for σ we postulate the value 1. The latter one corresponds with the results found by Börsch-Supan (1982). This implies a linear utility function. In this way we can include the discounted value of the wage income and benefit income separately. The parameter α is then inserted in the coefficient for the discounted value of the benefits. The mortality rates have been derived from Statistics Netherlands (1999) and refer to the period 1993-1997.

4. Estimation results

The survey allows us to estimate two models. Firstly, the respondents have been asked at which age they want to retire under the assumption of full coverage. The results based on

[5] An alternative is to apply the multivariat probit model. Here, it is assmed that the error terms e_{ij} in Eq. (4) are independently and identically distributed with a normal density functions. normale dichtheidsfunctie. However, this becomes a very complicated model to estimate. Further, there are no reasons to auppose that this model is more starightforward.

[6] For our estimation we make use of the program described in "Mixed Logit Estimation Routine for Panel Data" by Kenneth Train, David Revelt and Paul Ruud. This routine has been written in Gauss.

this question will be indicated by **Model 1**. The second type of questions involved a repeated binary choice. It is, for example, asked whether one wants to retire at age 61 or the alternative to work up to the compulsory retirement age of 65 years. Then the same question has been asked for the age of 63 years old, and so on. And, as said before, this binary choice question has not only been asked under the assumption of full pension coverage but also for partial coverage. The estimation results on the basis of these questions is referred to as **Model 2**.

In **Model 1** we have – apart from partial non-response – three observations for each individual (VUT-scheme, pre-pension scheme and flexibel pension scheme). The estimation results can be found in table 4. The mixed nature is expressed in the variables Benefits (the discounted value of the pension benefits) and Income partner (the current monthly income of the partner, if present). The other variables are: Wages (the discounted value of the wage income), Presence partner (dummy = 1 if a partner is present), Number of persons in the household, Sex (male = 0; female = 1), Part-time factor (the degree of labor participation; full-time = 1), Year of birth –1945, Dummy initial year (dummy =1 if the concerning age is the first possible age to retire), Dummy last year (dummy =1 if the concerning age is the last possible age to retire), Dummy 'old' (dummy =1 if retirement age > 68). Other variables, like partner's age and level of education do not have a significant impact.

== about here table 4 ==

Most striking is the significant impact of Dummy initial year and Dummy last year. We already take into account the censored nature of the three schemes. Apparently, there is a strong preference to retire on the first or last possible occasion. A part of the population wants to retire soon as possible, whereas another part want to work long as possible. Dummy 'old' shows that at ages 69 and over the preference for leisure is higher in comparison with younger ages. The expected health status might play a role here. The resulting estimated retirement probablities for the three schemes can be found in table 5.

== about here table 5 ==

The model results in a slight underestimation of the average retirement age. However, the deviation is limited. The largest ones refer to the retirement probabilities at the age of 60 for the VUT and the pre-pension scheme. The latter is compensated for by the retirement decisions at the age of 59 years. The impact of lower pension coverage on the basis of **Model 1** has been reported in table 6. This lower pension coverage results in lower benefits after retirement (with the exception of the benefit up to the age of 65 years for the VUT-scheme). We look – besides full coverage on the basis of 40 pension years – at the average age of retirement on the basis of coverage of 35 pension years and of 22.5 pension years.

== about here table 6 ==

A lower discounted value due to less than full pension coverage hardly affects the average retirement age for the VUT-scheme. The VUT-benefit is independent on the pension coverage. Refraining from early retirement does not either result in a higher benefit from the age of 65. This explains the model outcome. For the pre-pension and flexible pension scheme we find a slight increase in the average age of retirement. However, the answers on the type of questions on which **Model 2** will be based, show considerably larger effects. We will come back to this later.

First, we discuss Model 2. Taking into account the censored nature of the survey questions, we get the following estimation result; see table 7. Here, we estimate a conditional logit model. We refrain from the mixed logit model as this consumes huge computer time. The socio-economic variables from Model 1 have been inserted here also. In stead of the dummies for the initial and last year (which cannot be inserted now), dummies for the type of scheme (whereby the VUT-scheme is the reference scheme) and the pension coverage (quadratic) have been introduced.

== about here table 7 ==

Strikingly, the pension coverage is significant. This means that the impact of partial pension coverage on the retirement decision does not only run by means of a lower discounted value of the benefit. The impact is stronger than can be derived from the lower benefits and this is represented by the significance of the (lack of) pension coverage. A possible explanation is that the respondents not only take into account the benefit level, but also look at the benefit they would have received in case of full pension coverage. From additional survey questions it appears that the larger part of the respondents strives to a pension benefit that equals at least 70% of last earnings. A lower outcome than expected then may lead to the decision to work longer. This delay serves the possibility to save extra money, which can be used to come closer to the aspiration level. Another possibility is that equity considerations play a role. Because one did not pay contributions for full coverage, one might be inclined to think that it is not justified to make use of the scheme that early. We cannot exclude the possibility that answers have been given that are considered societally desirable. This is one of the disadvantages of the applied method. However, no further indications for such a behaviour can be found in the data.

Simulations on the basis of Model 2 show that this model is not able to replicate the answers on the questions on which Model 1 has been based. This is caused by the circumstance that due to the binary choice, we are not able to take account of the impact of the variables ‘Dummy initial year’ and ‘Dummy last year’. On the other hand, Model 2 clearly indicates the independent effect of the pension coverage (the number of years during which pension claims have been built up), which cannot be inserted in the equation to be estimated in Model 1. For, the questions on the basis of which the latter model has been estimated, only refer to full pension coverage.

As Model 1 gives a good description of the reported retirement behaviour under full pension coverage, we therefore add in Model 1 the coefficients for the pension coverage from Model 2. In the ideal case, one would re-estimate Model 2 with the same variables

as used in Model 1 and add to this the variable 'Pension coverage' (in a quadratic form), whereby the coefficients of the variable used in Model 1 have been set at the values found in the estimation of that model. However, as said, it is impossible to include the dummy variables for the first and last year for which one is eligible for the various schemes. We therefore normalize via the error term. The starting-point is equation (7). Let this be the specification for Model 1. Let *z* be the pension coverage and α_j and γ_j (j=1,...,J), the estimated coefficients for the lineair and quadratic term in Model 2, respectively. Then the impact of the pension coverage can be incorporated in Model 1 as follows:

$$(8) \qquad P_{ij} = \exp(x'_{ij} .\beta + \alpha_j.(z-1) + \gamma_j.(z^2-1)) / \sum_{j=1,J} \exp(x'_{ij} .\beta + \alpha_j.(z-1) + \gamma_j.(z^2-1))$$

On the basis of full pension coverage, this gives the same results compared to Eq. (7). The resulting cumulative retirement probabilities have been shown in figure 1. The resulting average age of retirement has been shown in table 8. Here, also the effect of one year less pension coverage has been given. We now find compared to table 6 a substantial impact of partial pension coverage. Having only a pension coverage on the basis of 22.5 years in stead of 40 years results in a delay of retirement by on average 1.42 years for the VUT-scheme, 1.85 years for the pre-pension scheme and 1.42 years for the flexible pension scheme. One year less pension coverage results in a delay of retirement by 0.1 to 0.2 years. The impact is the highest for the pre-pension scheme. That can be explained by the benefit structure, which contains more financial incentives for the pre-pension and flexible pension scheme in comparison with the VUT-scheme and by the circumstance that the first age at which one is eligible to make use of the scheme is very low. From the latter point of view, in particular the flexible pension system has only limited room for further delay. The impact appears to be somewhat larger for women compared to men. For example, on the basis of a pension coverage of 27.5 years, women show on the basis of the flexible pension scheme a delay of 1.59 years against men 1.33 years, a difference of 0.26 years. For the VUT-scheme the difference amounts to 0.11 years and for the pre-pension scheme 0.10 years.

5. The situation in 2000 and consequences for the future

The estimation results for the extended Model 1 have been implemented in the microsimulation model NEDYMAS (see Nelissen, 1994). We first look at the results found for the year 2000. A problem is that information on the kind of scheme individuals fall is largely lacking. We only know that 20% of the employees belongs to a scheme that is comparable to the VUT-scheme used here, 20% to a pre-pension scheme, 50% to a combination of both and 10% does have an employer who offers an early retirement scheme. Assuming that people aged 60-64 years old fall under the VUT-scheme when both schemes apply, the simulation results in 101,000 persons that make use of the VUT-scheme and 27,000 persons that make use of the pre-pension scheme. In total, we find 128,000 pre-retired persons in the Netherlands in 2000. In reality, 148,000 persons make use of early retirement schemes. So, we have an underestimation of 20,000 persons. An explanation for this is the presence of transitional arrangements in the case that pre-pension schemes are introduced (this holds, for example, for PGGM, one of the largest pension funds). If these hold for all people aged 60-64 years we find 144,000 participants. Besides it appears that early retirement benefits sometimes are supplemented by extra benefits (e.g. in cases of reorganizations). We do not have sufficient information on this subject to take account of it. But, all in all, it appears that the model is able to replicate the situation in 2000.

We now first look what the impact of the various schemes is on the basis of the population in 2000. To that end we simulated the number of early retired persons assuming that only the VUT-scheme was at work, or only the pre-pension scheme or only the flexible pension scheme. We again suppose that such a scheme then holds for 90% of the employees, whereas the other 10% are not eligible for such a scheme. Table 9 reports. This table clearly indicates the impact of a transition towards schemes that are characterized by a larger degree of actuarial fairness. This would increase the participation rates by 3 to 5% among the age group under consideration.

Analogous calculations have been made for the years 2010 and 2020. The population and labor market development (with the exclusion of early retirement) has been based on the

European Coordination scenario of the Central Planning Agency; see Statistics Netherlands / CPB Netherlands Bureau for Economic Policy (1997). The results can be found in table 10. Here, the gain due to a transition to pre-pension en flexible pension schemes is even larger. The participation rate increases by 5 to 8% in 2010 and 7 and 12% in 2020. Complete actuarial fairness results in 2020 in an additional 2% higher participation rate. The changes between 2000 and 2020 are mainly caused by the changes the higher participation among women and as a consequence an increase in partner's average income. The changes in the level of education and the pension coverage are of less importance.

6. Evaluation

Originally the early retirement scheme (VUT) in the Netherlands results in a benefit that equals 80% of last earnings and this benefit is independent of the age at retirement. As a consequence the implicit tax rate is very high. Last years we observe a transition towards schemes which show a larger degree of actuarial fairness. In this contribution we looked at the impact of this type of changes. As useable data are not yet available, the impact of these changes has been analyzed on the basis of observations based on stated preferences. To that end a survey has been held via Internet. The respondents had to answer two types of questions. In the first type they were asked the preferred retirement age for three types of (early) retirement schemes. In the second type they had to make binary choices on the basis of the same schemes. In that way we gathered repeated choice data. This type of data has been analyzed using the mixed logit model (or random parameters logit model).

Probably the the most important finding of this contribution is the independent role that the number of years for which has built up pension claims. This impact does not only run via the discounted value of future pension streams. A lo. A lower pension coverage affects the desired retirement age even to a larger extent than the decrease in the discounted value forecasts; compare tables 6 and 8. It should be noted that the coefficient for the discounted value of future pension streams is of the same magnitude as Börsch-

Supan reports for Germany.[7] This finding may suggest that former studies underestimate the effects of changes into the direction of actuarial fair pension systems. In this, we have to emphasize that we analyzed stated preferences. This might imply that the impact has been overestimated due to socially desirable answers. However, it should also be noted that the model is clearly able to reproduce the exit behavior via early retirement schemes in the Netherlands for the year 2000.

Another finding is the apparent strong preference of respondents to retire on the first or last possible occasion. This is an indication that part of the population has a strong preference for leisure, whereas another part wants to continue to work long as possible. For these groups, the financial incentives have an only limited impact.

The analysis further makes clear that the transition from VUT-schemes to schemes that are characterized by a larger degree of actuarial fairness which started a couple of years ago, will result in higher participation rates among the 55 tot 64 years old population. In the long run a participation rate of 50% is within reach. This is one of the main objectives of the Dutch government.

It also appears that an extra benefit when retirement is delayed to the age of 63 years or later has an only limited impact. The other side is that such an additional benefit will be costly, as such a benefit will have a general nature. Part-time early retirement on the basis of a labor week of 24 hours results in an on average 0.5 years lower retirement age, but due to the point one works 24 hours a week until the age of 65, the participation rate will be higher. However, part-time retirement is clearly less appreciated than full-time retirement. At last, it should be noted that only few persons prefer to work after the age of 65.

[7] Albeit that our coefficient in table 4 has to be divided by 12 in order to be comparable to the results found by Börsch-Supan. We the have a coefficient of 0.0104 against 0.0096 in the latter's preferred model.

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Table 1. Benefits as a percentage of final wages (full coverage)*

Age of retirement	VUT		Pre-pension		Flexible pension	
	< 65	65+	< 65	65+	< 65	65+
55			16	37		
56			20	41		
57			25	44		
58			43	54		
59			54	61		
60	80	70	60	65		
61	80	70	65	67	64	64
62	80	70	70	70	70	70
63	80	70	85	74	75	75
64	80	70	95	80	81	81
65	---	70	---	85	89	89
66					97	97
67					106	106
68					116	116
69					127	127
70					140	140

Table 2. The implicit tax rates

Age of retirement	VUT	Pre-pension	Flexible pension
55		-23%	
56		-23%	
57		-109%	
58		-37%	
59		13%	
60	84%	33%	
61	79%	40%	-2%
62	80%	23%	20%
63	78%	43%	16%
64	78%	64%	1%
65			37%
66-68			88%

Table 3. The distribution of the preferred age of retirement (in %)

Age	VUT	Pre-pension	Flexible pension
55		7.3	
56		0.5	
57		2.1	
58		4.7	
59		0.0	
60	64.8	21.0	
61	8.3	4.9	38.9
62	8.0	11.9	17.8
63	0.8	6.2	13.8
64	0.3	1.0	5.4
65	17.3	40.4	16.2
66			1.1
67			2.7
68			0.8
69			0.0
70			3.2
Average age at retirement (N)	61.10 (398)	61.99 (386)	62.83 (370)

Table 4. Estimation results for Model 1 (censored); between brackets standard deviation*

Age	55	56-59	60	61	62	63	64	65	66-68	69-70
Wages/12	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023	0.023
	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)	(0.008)
Benefit/12 (av.)	0.213	0.213	0.213	0.213	0.213	0.213	0.213	0.213	0.213	0.213
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)
Benefit/12 (s.d.)	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125	0.125
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
Income partner / 1000 (av.)			1.801							
			(0.318)							
Income partner / 1000 (s.d.)			3.492							
			(0.662)							
Presence partner					0.911					
					(0.140)					
Number of persons in hh	-0.171									
	(0.103)									
Sex							-1.464		-0.957	
							(0.506)		(0.593)	
Part-time factor								0.716		
								(0.182)		
Year of birth	0.091								-0.069	
	(0.036)								(0.033)	
Dummy initial year	1.628	1.628	1.628	1.628	1.628	1.628	1.628	1.628	1.628	1.628
	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)	(0.114)
Dummy last year	2.031	2.031	2.031	2.031	2.031	2.031	2.031	2.031	2.031	2.031
	(0.191)	(0.191)	(0.191)	(0.191)	(0.191)	(0.191)	(0.191)	(0.191)	(0.191)	(0.191)
Dummy 'old'										-2.393
										(0.397)

* Before the estimation, some ages were added into one category in order to save computer time.
Loglikelihood = -1662.19; 1103 observations.

Table 5. Estimated (E) and reported (O) retirement probabilities by age (Model 1)

Age	VUT		Pre-pension		Flexible pension	
	E	O	E	O	E	O
55			6.8	7.5		
56			1.6	0.5		
57			2.0	2.1		
58			5.0	4.8		
59			7.8	0.0		
60	70.7	64.2	13.7	20.8		
61	5.3	8.5	6.3	4.0	42.4	39.3
62	6.8	8.8	11.0	11.7	19.4	17.7
63	2.1	0.8	4.6	5.9	8.6	13.1
64	0.1	0.3	2.8	1.1	6.0	5.7
65	15.0	17.5	38.3	41.6	17.2	16.2
66-68					4.2	4.8
69-70					2.2	3.1
Average age of retirement	61.00	61.17	61.80	62.02	62.68	62.83

Table 6. Impact of less than full pension coverage (Model 1)

Scheme \ Coverage				Impact of one pension year less	
	40	35	22.5	40->35	35 ->22.5
VUT	61.00	61.00	61.01	+0.000	+0.000
Pre-pension	61.80	61.95	62.15	+0.030	+0.027
Flexible pension	62.68	62.74	62.84	+0.012	+0.013

Table 7a. Estimation results for Model 2 (censored); between brackets standard deviation; Part I

Age	55	56	57	58	59	60	61
Wages/12	0.019	0.019	0.019	0.019	0.019	0.019	0.019
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Benefit/12	0.041	0.041	0.041	0.041	0.041	0.041	0.041
	(0.010)	(0010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Income partner/ 1000		0.126			0.122		
		(0.046)			(0.055)		
Presence partner							
Nr. of persons in hh							
Sex		-0.603		0.443			0.619
		(0.283)		(0.211)			(0.124)
Part-time factor							
Year of birth	0.053			0.046			
	(0.017)			(0.016)			
Pension coverage	-5.530	-5.530	-5.530	-5.363	-5.363	-5.719	-5.719
	(0.922)	(0.922)	(0.922)	(0.902)	(0.902)	(0.605)	(0.605)
Pension coverage sqd.	5.306	5.306	5.306	5.445	5.445	6.747	6.747
	(0.913)	(0.913)	(0.913)	(0.902)	(0.902)	(0.542)	(0.542)
Dummy VUT						0.778	0.784
						(0.146)	(0.140)
Dummy flexible pension							8.242
							(3.116)

Table 7b. Estimation results for Model 2 (censored); between brackets standard deviation; Part II

Age	62	63	64	65	70
Wages/12	0.019	0.019	0.019	0.019	0.019
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Benefit/12	0.041	0.041	0.041	0.041	0.041
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
Income partner/ 1000		0.096			
		(0.028)			
Presence partner				-0.659	
				(0.081)	
Nr. of persons in hh				0.062	
				(0.024)	
Sex					
Part-time factor				0.814	
				(0.156)	
Year of birth					
Pension coverage	-3.238	-3.238	-1.353		15.601
	(0.511)	(0.511)	(0.750)		(7.512)
Pension coverage sqd.	4.692	4.692	2.445		-10.425
	(0.435)	(0.435)	(0.738)		(4.477)
Dummy VUT	0.369	0.311			
	(0.169)	(0.172)			
Dummy flexible pension	7.571	7.557	7.555	8.507	2.669
	(3.114)	(3.113)	(3.112)	(3.110)	(0.586)

Loglikelihood = -5670.3; 8621 waarnemingen.

Table 8. Impact of less than full pension coverage (extended Model 1)

Scheme \ Coverage				Impact of one pension year less	
	40	35	22.5	40->35	35 ->22.5
VUT	61.00	61.61	62.42	+0.122	+0.108
Prepensioen	61.80	62.76	63.65	+0.192	+0.119
Flexpensioen	62.68	63.38	64.10	+0.140	+0.096

Table 9. Impact of early retirement schemes on labor participation of 55 to 64 years old persons in 2000

	Number of early retired persons	Participation rate
Current situation	148,000	31.4%
Only VUT-scheme	130,000	32.5%
Only pre-pension scheme	78,000	35.9%
Only flexible pension scheme (net impact*)	44,000	38.1%

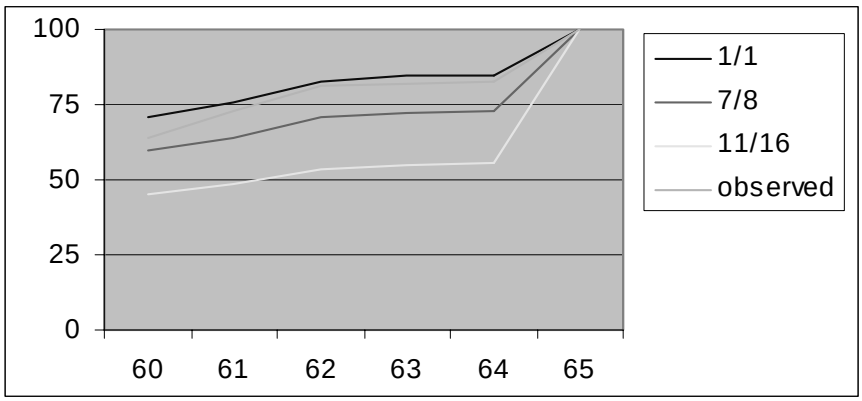
* Number of retired persons minus the number of persons working after the age of 65 years old.

Table 10. Impact of early retirement schemes on labor participation of 55 to 64 years old persons in 2010 and 2020

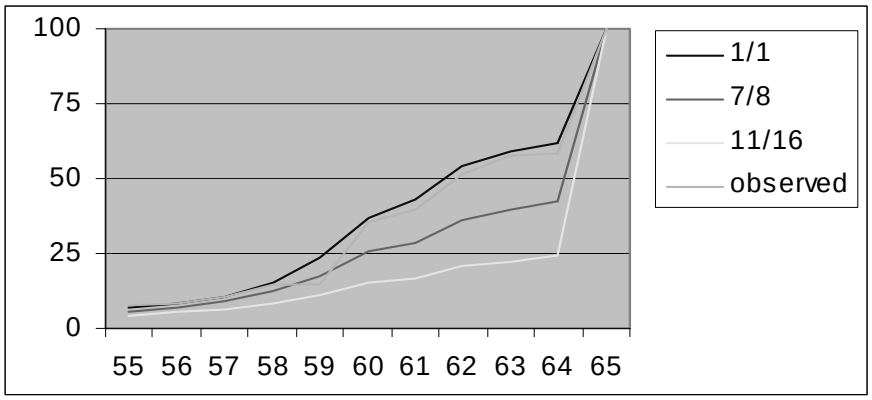
Participation rate	2010	2020
Only VUT-scheme	32.5%	36.0%
Only pre-pension scheme	37.0%	42.7%
Only flexible pension scheme (net impact)	40.3%	48.2%

Figure 1.Cumulative retirement probabilities on the basis of the extended Model 1

VUT-scheme



Pre-pension scheme



Flexible pension scheme