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Labour-incentive reforms at preretirement age in Austria

Isilda Mara · Edlira Narazani

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Abstract Low participation rates of older workers in the labour market threaten the sustainability of the pension system in Austria. Given the current political debate on this issue, we try to shed light on employment and retirement behaviour of Austrian couples when income support is provided and pension benefits are reduced. Using a sample of married couples with both partners aged 50–65, we find that the proposed reform increases the labour supply of middle-income men whereas the effects on women are weaker. However, somehow surprisingly, we find that these reforms have an increasing effect on unemployment/inactivity probabilities which in turn is outweighed by a decreasing effect on the retirement probabilities in case of women. These findings emphasize the importance of a joint consideration of labour supply and retirement behaviour of married couples when introducing pension reforms and tax-benefit policies.

Keywords Labour supply · Discrete choice models · Guaranteed minimum income · Retirement

1 Introduction

Austria has very low labour market participation rates among workers close to retirement age. According to Hefler (2006) in 2005, 43% of men and 23.5% of women of that age group (combined, 33%) were employed. In 2005, only five of the

I. Mara
Wiener Institut für Internationale Wirtschaftsvergleiche (wiiw), Rahlgasse 3, 1060 Vienna, Austria
e-mail: mara@wiiw.ac.at
URL: http://www.wiiw.ac.at

E. Narazani (✉)
Department of Economics "Cognetti de Martiis", Via Po, 51, 10124 Turin, Italy
e-mail: narazani@econ.unito.it

25 Member States of the European Union (EU-25) had lower participation rates. Like in other EU countries, the labour market participation among older workers and the keeping up of their employment is a prominent issue. The ageing of the population and the necessity for reforms in the pension system have important repercussions not only for the individuals who are in the commencement of their working carrier but also for those who are finalizing it. Given the increase in longevity and the attractiveness of the early retirement schemes, the governments are inclined toward the implementation of policies that delay the retirement decision and encourage the labour market participation of older workers.

Hofer and Koman (2006) attempt to analyse the impact of the public pension system on the labour market participation and retirement decision of workers close to pre-retirement age, and find that the features of the Austrian pension system provide significant incentives to retire. The continuation of participation in the labour market before retirement age is penalized by high marginal tax rates, which consequently provide significant incentives for early retirement. Keuschnigg and Keuschnigg (2004) using Austrian data show that lowering the pension replacement rate and increasing the retirement age have a strong labour market effect. Ichino et al. (2007) using Austrian firm-level data demonstrate that immediately after plant closure, the old individuals have lower re-employment probabilities as compared to younger workers but later they catch up. They conclude that increasing the retirement age does not necessarily yield individuals who are "too old to work but too young to retire".

Ney (2004) argues that the reforms in Austria may be effective in keeping older workers out of the pension system, but they provide little incentive to keep them in the labour market. He also argues that the abolishment of early retirement not supplemented with active labour market policies, both on the supply and demand side, risks to be unsuccessful to reach the target group, especially those at the margins of the Austrian labour market.[1] Börsch-Supan (2000) shows that in case of Germany early retirement absorbs a substantial fraction of total pension expenditures and it accounts for about a third. Moreover, Fuchs and Lietz (2007), using micro-simulation techniques, show that the abolishment of unemployment insurance contributions for female workers above age of 56 and male workers above age of 58 rewarded only employees with higher incomes.

Concerning the literature on labour supply behaviour of older workers, empirical studies using US data (Munnell et al. 2008) show that the replacement rate has a strong impact on the decision to retire. They argue that not only the availability of benefits plays an important role but also the level of benefits and replacement rates are determinant factors for the decision to retire or to continue participating in the labour market.

From the perspective of pension system, the three basic measures activated to offset the shrinking of the labour force are pension benefit reductions, increase of

[1] However, the Austrian government has introduced few active labour market policies, both on the supply and demand side, such as part-time allowance for older workers (Altersteilzeitgeld) and different forms of part-time and flexible pension arrangements. See Federal Ministry of Economics and Labour (2008).

contributory and tax rates and shifting up of the statutory retirement age.[2] However, these reforms need to be complemented with active labour market policies in order to encourage employment of older workers. Apart the measures mentioned above, policies such as in-work income support schemes for older workers above the age 50 along with pension benefit reductions for those who retire earlier could discourage early retirement; encourage postponement of receiving pension benefits, accumulation of more contributory years in the pension system and consequently higher pension benefits on the old-age retirement. Thus, the use of several instruments, both sticks and carrots, would ensure keeping older workers in the labour market and collecting more years of contribution in the pension system. By receiving in-work income support, the worker perceives a higher income level for the time being. As for the future, he foresees higher pension benefits because of the postponed retirement and the accrual of more contributory years. The penalties in pension benefits, in case of opting for early retirement schemes, would make him perceive lower pension entitlements compared to earnings from work.

Employment and labour supply decisions of older workers are not only an issue of participation in the labour market but are also subject to hours of work. Therefore the impact of tax-benefit regimes at the margin of labour supply has to be analysed simultaneously. According to Saez (2002), potential labour supply responses both at the intensive and extensive margin are equally crucial and the analyses of labour market decisions have to be considered at both margins when alternative tax-benefits systems are implemented. In addition, he finds that an implementation of a Negative Income Tax (NIT), which is a combination of a guaranteed subsistence income along with the taxation of earnings above this amount, has a strong impact on labour supply responses at the intensive margin. Nevertheless, when labour supply responses prevail at the extensive margin, tax-benefit system such as WorkFare (WF), which is basically a NIT conditional on a minimum of working hours, are found to be the proper ones. Moreover, Michaud (2004) sustains that active labour market policies such as in-work tax credit, implemented in some countries like the UK, the Netherlands, Canada and the USA, have had a positive effect on labour supply decisions, and the labour supply elasticity in terms of extensive margin appear to be more significant for low-income earners.

Our paper focuses on the analysis of tax-benefit policies which aim to maximize the utility of the older worker subject to a budget constraint on available payouts, e.g. labour income, social transfers or pension's entitlement. Labour supply decisions of older workers are analysed in a general context of available income support schemes and barriers to retire. In this paper we use a static labour supply to simulate the effect of four policy reforms on labour supply behaviour and income distribution of individuals above the age of 50. In particular, these reforms are based on the combination of a minimum guaranteed income scheme conditional on working hours (such as NIT or WF) and a reduction in accrued pensions in line with

[2] For more details on pension reforms, see Bovenberg (2003), Keuschnigg et. al (2010), Feldstein (2005), Fenge and Pestieau (2005), Casamata et. al (2001), Lindbeck (2001), Lindbeck and Persson (2003), McHale (1999) and Gruber and Wise (1999, 2002, 2005).

the pension reforms of 2003 and 2004 and the pension benefit modifications in 2007 which in turn are only related to pension corridors.[3,4]

Tax-benefit microsimulation models serve to answer to the question "What-if" certain polices changes were introduced. Therefore, by using a static micro-simulation model we intend to measure the "over-night" effects that such policy reforms could have on labor supply of the individuals above age of 50.

The rest of the paper is organized as follows. The next section gives an overview of the Austrian pension system, labour market and description of hours of work decisions of older workers disaggregated by gender and age. The third section discusses the features of the micro-econometric model and the dataset. The fourth section illustrates the simulated reforms. The results are presented in the fifth section. The last section concludes.

2 An overview of the Austrian pension system and the labour market of the older workers

Empirical evidence shows that many Austrians withdraw from the labour market well before reaching the statutory or even the early retirement age. Consequently, only one in three individuals aged between 55 and 64 participate in the labour market, a level significantly lower than in most of other OECD countries. Biffl (2006) shows that one of the main reasons of low activity among older workers is the below average skill level. The low-skilled workers are underrepresented while the reverse is true for the high-skilled ones; therefore she suggests that there is room for improvement and increase of employability of less-skilled older workers. Biffl (2006) also shows that the unemployment rates are strongly linked to the education level and the low-skilled older workers have a relatively higher unemployment rate compared to the high skilled ones. Moreover, she shows that Austria has a low share of part-time employment, which could be partly explained by the lack of incentive to take up certain working contracts because of high marginal tax rates. Consequently public policy should introduce financial incentives for older workers to remain in gainful employment. While reducing effective marginal income tax would encourage retention of older workers above 64 in the gainful employment for those below this age the retention of the work would be encouraged through activating labour market polices and ensuring adequate work incentives.

According to the OECD (2005a, b), since the mid-1990s, even though different measures are undertaken in Austria to improve labour market opportunities for older workers, the outcome for this group of the population has changed very slowly and

[3] While the pension reforms 2003–2004 raised benefit deductions for early retirement to 4.2% per year, the 2007 pension reform halved it to 2.1% despite the OECD policy recommendation. For a comprehensive overview of the Austrian pension system, see Hofer and Koman 2006.

[4] A pension corridor means that the individuals can retire within a corridor between 62 and 65 with a pension discount, and between 65 and 68 with a pension supplement.

existing early retirement schemes are still widely used.[5,6] In addition, the causes of low participation rates among older people in Austria and especially women are to be found in the structure of the social protection system of this country. In 2004, social protection expenditures accounted for 29.1% of GDP versus 27.6% in EU15 and especially expenditures on old age account for a large part of social benefits.[7]

Apparently, the experience of Austria and other EU countries indicates that the availability of early retirement schemes, the generosity either in maximum time or in benefits of disability pension seem to be the main causes of the early withdrawal of older workers from the labour market.[8] In effect, the restriction of the availability of such schemes in Germany and the UK did have a positive effect in the labour market participation of older workers.[9]

Since 2000, several pension reforms have been proposed and implemented in Austria with the aim of improving the sustainability and the actuarial fairness of the Austrian pension system. The reform in 2000 led to the abolition of early retirement due to reduced capacity to work, the gradual increase of the early retirement age by 18 months in total, up to 61.5 years for men and 56.5 years for women, the tightening of the eligibility criterion for survivors' pensions and, lastly, the increase of early retirement discounts to 3 accrual points per year. According to the OECD Report (2005a, b), the regulations introduced in 2004 have tightened the eligibility rules for the old-age part-times scheme. Moreover, the regulations of 2003 and 2004 presume the same normal retirement age (65 for men and 60 for women) as before.

The statutory retirement age was 65 for men and 60 for women in 2003 and a corridor between 62 (if at least 37.5 years of insurance) and 68 for men and women. The replacement rates were set at 80% for 40 and 45 years of insurance respectively by the pension reforms of 2003 and 2004. There were also some changes related to the calculation base with the best 40 years (in 2028) of income during the insurance career in 2003 and all years of insurance in 2004. Instead, early retirement due to long insurance duration is abolished gradually until 2017 while the age for early retirement, due to the long insurance period, is increased to 60 for women and 65 for men until 2017.[10]

The pension reforms of 2003 and 2004 increase the pension discount for each year of early retirement to 4.2%, up to a maximum of 15% of the pension entitlement. In 2007, the Austrian Parliament decided to cut the discount rate for early retirement by half (from 4.2 to 2.1% for pension corridors only, for each year of early retirement).

[5] See the OECD report 08/09/2005 "OECD urges Austria to do more to encourage older people to work longer" and also Zaidi, Makovec and Fuchs (2006) "Transition from work to retirement in EU25".

[6] Even though several political initiatives have been taken to fulfil the Stockholm goal of 50% participation of older employees, the total employment rate has remained almost unchanged over the last decade.

[7] Source: Eurostat (2004) (see Tables 10 and 11, Appendix 1).

[8] See OECD report (2005a, b) "Aging and Employment Policies, Austria".

[9] See The OECD Observer No. 212 (1998) "Retire early, stay at work?".

[10] See Hefler (2006), Labour Market Participation of Older People (55–64) in Austria—A Background Report.

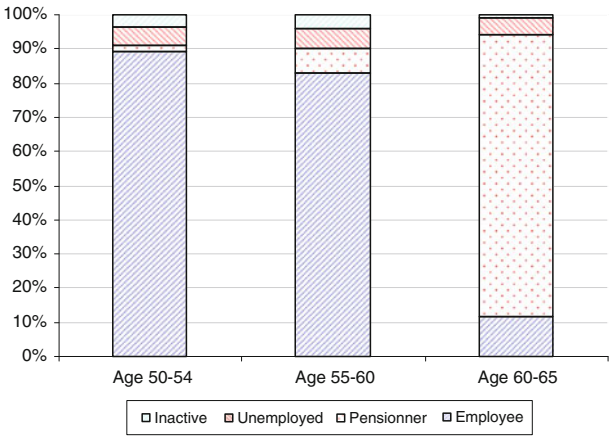


Fig. 1 Employment status of males segregated by age

If nothing else changes, low labour market participation among the elderly along with early retirement possibilities will contribute to the frailty of the pension system in Austria. Despite the modifications of the existing pension schemes, Austria's adjustment of pension benefits for early and late retirement is still low.[11] An annual reduction of 4.2% of the access to early retirement schemes is still low compared to other OECD countries while reductions in pension benefits might harm low-income individuals unless an income support is provided by the state.

In this paper we use cross-section data from the second wave of the EU-SILC for Austria (2004, with income data from 2003) issued by Statistics Austria. EU-SILC is a survey on income and living conditions and intended to analyse the distributional effects of disposable household incomes and their components. The data are representative for the Austrian population and provide detailed information on income and employment status both at the household and the individual level. We have selected only married couples where both members are aged 50–65 years. None of them are self-employed, employer or disabled.

Figures 1 and 2 show the share of males and females disaggregated by age and employments status (inactive, unemployed, pensioner and employee). These figures indicate that with the increase in age, while the share of retirement status is dominating both for males and females, the employment spell reaches very low levels and the inactivity spell among females is relatively high compared to males. This evidence is compatible also with UNECE statistics (Table 12, Appendix 1), which show that in the age group 50–64, 85% of men are economically inactive for retirement reasons while in case of females only 64%.

Figures 3 and 4 below illustrate the share of men and women across alternatives (labour supply and pension alternatives) for each age group.[12] Looking at Fig. 3, it

[11] Reductions in pension entitlement would be linked to lower statutory contributions, which imply lower tax rates and therefore fewer disincentives to labour market performance.

[12] The vertical axes stand for the percentage of individuals across alternatives. There are 6 discrete alternatives of hours of work which are given in the right-hand side of Figs. 3 and 4. The 1st alternative

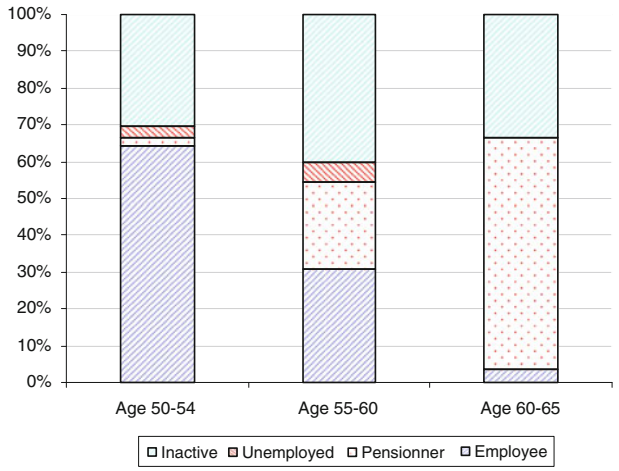
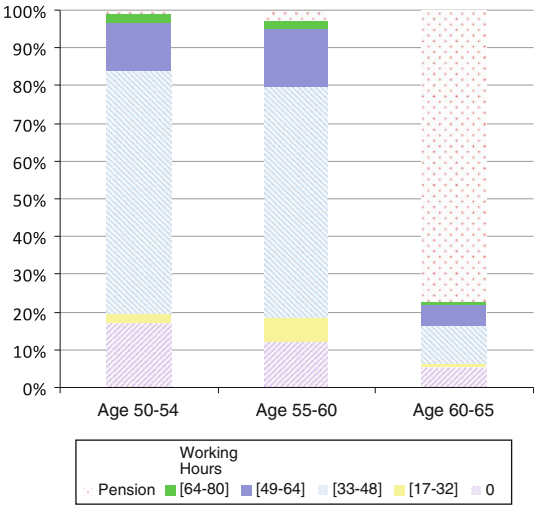


Fig. 2 Employment status of females segregated by age

Fig. 3 Male distribution across labour supply and pension alternatives by age group



may be noticed that there are two peaks, which refer to the full-time alternative and the retirement alternative. While in the full-time alternative most of men come from the youngest group, in the retirement alternative they come from the oldest group. Whereas men do not prefer the part-time alternatives, the alternative referring to the extra-time seems more preferred for the age group 55–60.

Footnote 12 continued
refers to unemployment and inactivity status, the 2nd, 3rd, 4th and the 5th respectively to the working hours interval (17–32), (33–48), (49–64) and (65–80) and the last alternative to the pension status. The difference between the first and the last alternative is income-driven such that in the former the individuals perceive only family benefits and other similar benefits while in the latter, the generated income are simply the pension benefits.

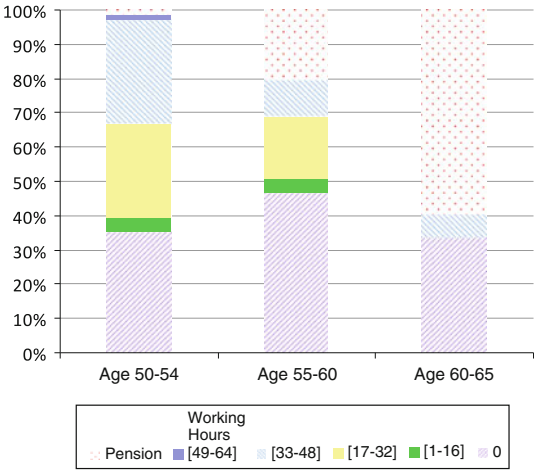


Fig. 4 Female distribution across labour supply and pension alternatives by age group

As shown in Fig. 4, female labour supply differs clearly from that of males due to the predominance of more than two peaks and especially that of the zero hours' alternative for each group. In the youngest group, most of women either do not work or work full-time while in the oldest group most of them either do not work or are retired. To conclude, men go through a normal transition from employment spell to retirement spell while women drag their inactivity status with them until the last period of their working career.

3 Micro-econometric modelling

In this paper we proceed as follow: first we estimate a micro-econometric model of labour supply similar to the random utility model developed by Van Soest et al. (2002) and Aaberge et al. (1999) and then use the estimated parameters to simulate different tax-benefit reforms which will be explained in the next section.

We have used EUROMOD, a tax-benefit model, to decompose original income, which is the sum of labour income and non-labour income, into its components such as net disposable income, taxes, social security contributions, family and individual benefits (here we include also pension entitlements).[13] This microsimulation tool allows incorporating labour supply and pension alternatives, i.e. the working hours, the pension choice and the respective generated income and analysing the static choices, made at some point in time, while it is assumed that the rational decision-maker maximizes utility. In our case, we will consider households with two decision-makers (couples) wherein both partners jointly decide to work (and how many hours) or to retire while the behaviour of other people within the household is

[13] We have modified the Austrian input database in EUROMOD to incorporate the working hours alternatives and generate their respective gross earnings for each couple. However we must point out that here, EUROMOD is used only to calculate budget sets for all the alternatives simultaneously while the tax-benefit reforms are modelled separately.

taken as exogenous. This static modelling—called differently myopic—does not take into account the future loss in inter-temporal utility due to the retirement option in the future.[14] However as Disney (2005) shows, people cannot optimize complex inter-temporal problems and in their decisions they break down the future to a single period. Other studies that analyze the decision making process of individuals and their behavioral response have shown that, individuals are rather crude in making their decisions concerning their future.[15] Usually the life cycle models of labour supply and retirement decision show that the individuals' reaction to pension benefits reductions depends on workers knowledge about their benefits. Mastrobuoni (2006) using a life cycle model shows that workers react strongly to reductions in benefits and increases in retirement age. Brown (2006) measures the probability that the older workers retire between two periods, close to the age, identified as the usual retirement age for themselves. He shows that the patterns found for the consecutive period continue to hold for at least three consecutive years. Therefore, in line with this belief, a static modeling helps to provide some evidence on behavioral response in the short-term.

Apart from the labour supply choice set, in this study we introduce an extra alternative—pension choice, which is the decision to retire from the labour market. Thus, the opportunity set of households is composed of 36 alternatives (5 alternatives of weekly working hours and 1 for the decision to retire per partner).[16] Then, the estimated parameters of the model are used to simulate the optimal choices made by individuals under the constraint of constant net tax revenues when four different tax regimes are applied.

The main assumptions in our modelling are:

1. First, individuals can choose either to work or to retire, but only inside the couple and in the simulation scenario they are allowed to mix up the retirement choice with their labour supply.
2. The pensions are imputed using a Heckman selection prediction and no market interest rate is used to index the future flows of the pension entitlements.[17,18]
3. The reforms simulated in this paper are meant only for couples close to retirement age Therefore we modify only the labour behaviour of this selected sample while keeping unchanged the others' labour supply. We assume budget neutrality for the selected sample which means that both taxes and benefits are changed only for old workers without affecting the rest of the population.

[14] Colombino (2003) develops and estimates both forward-looking and myopic versions of a structural model of retirement by including or dropping the term measuring the future loss of retiring. We intend to follow this approach in a future study.

[15] See Bovenberg (2003).

[16] Thus, the opportunity set of households is composed of 36 alternatives, which is a combination 6×6 of the alternatives for both partners (5 alternatives of weekly working hours and 1 for the decision to retire per partner).

[17] The social security contributions are treated as in the current system.

[18] Moreover, the data do not provide information on the earnings history and do not allow in this way to apply the rules for the calculation of the pension benefit computation.

Household n is assumed to maximise a utility function $U^i\left(X^n, P_F^n, P_M^n, h_F, h_M, d_F, d_M\right)$ under the constraints:

$$\begin{aligned} h_{\mathrm{F}} &\in \Omega \\ h_{\mathrm{M}} &\in \Omega \\ d_{\mathrm{F}} &\in \Omega \\ d_{\mathrm{M}} &\in \Omega \\ P_{\mathrm{F}} &= f\left(\mathrm{Age}_{\mathrm{F}}, W_{\mathrm{F}}^n, \#\mathrm{Contributions}_{\mathrm{F}}, Z_{\mathrm{F}}\right) \\ P_{\mathrm{M}} &= f\left(\mathrm{Age}_{\mathrm{M}}, W_{\mathrm{M}}^n, \#\mathrm{Contributions}_{\mathrm{M}}, Z_{\mathrm{M}}\right) \\ X^n &= R\left(w_{\mathrm{F}}^n h_{\mathrm{F}}, w_{\mathrm{M}}^n h_{\mathrm{M}}, d_{\mathrm{F}} P_{\mathrm{F}}, d_{\mathrm{M}} P_{\mathrm{M}}, y^n\right) \end{aligned} \tag{1}$$

where:

h_i = average weekly hours of work required by the j-th job in the choice set for partner i (F = female, M = male)

d_i = dummy variable which takes value one when the pension alternative is chosen by the partner i (F = female, M = male)

P_i = average income deriving from the pension alternative for partner i (F = female, M = male) as a function of some individual variables (e.g. age, last average monthly wage, number of years of contribution, other characteristics)

Ω = set of discrete values (6 alternatives for each household member, 5 alternatives of working hours, from 0 to 80 weekly hours and 1 pension alternative)

w_i^n= hourly wage rate of partner i. In order to simulate potential in-work disposable income for those who are observed to be out of work in the data, the hourly earnings equation is estimated after having estimated the inverse Mill's ratio. The same holds also for the pension entitlement.

y^n = vector of exogenous household gross income

X^n = net household income

R = tax-transfer rule that transforms gross income into net income. The tax rule is applied on monthly gross income.

The first two constraints state that the working hours h_i are chosen within a discrete set of values Ω including also the choice of 0 h (i.e. non-participation or unemployment).[19] This discrete set of "h" values can be interpreted as the actual choice set (maybe determined by institutional constraints) or as approximations to the choice set. The second two constraints state that the choice set contains a further alternative corresponding to the retirement decision. The fifth and sixth constraints say that the pension entitlements are derived as a function of a set of monetary and non-monetary variables whereas the last constraint says that net income X is the result of a tax-transfer rule R applied to the gross income.

We write the utility function as the sum of a systematic part and a random component:

$$U^n\left(X^n, P_{\mathrm{F}}^n, P_{\mathrm{M}}^n, h_{\mathrm{F}}, h_{\mathrm{M}}, d_{\mathrm{F}}, d_{\mathrm{M}}\right) = V\left(X^n, P_{\mathrm{F}}^n, P_{\mathrm{M}}^n, h_{\mathrm{F}}, h_{\mathrm{M}}, d_{\mathrm{F}}, d_{\mathrm{M}}; Z^n, \vartheta\right) + \varepsilon \tag{2}$$

[19] EUROMOD does not simulate the unemployment benefits and for that reason we do not separate the inactive from the unemployed. This is one of the limitations of this model.

where Z^n is a vector of household characteristics, ϑ is a vector of parameters to be estimated and ε is a random variable capturing the effect of unobserved variables upon the evaluation of $\left(X^n, P_{\mathrm{F}}^n, P_{\mathrm{M}}^n, h_{\mathrm{F}}, h_{\mathrm{M}}, d_{\mathrm{F}}, d_{\mathrm{M}}\right)$by household n.

Let $G(f) = (1 - d_f)w_{\mathrm{F}}^n h_f + d_f P_f$ and $G(m) = (1 - d_m)w_m^n h_m + d_m P_m$ be the income generated by each household member. Then $R(G(f), G(m), y^n)$is the net available income when the household choice (f, m) is calculated using EUROMOD.

Under the assumption that ε is i.i.d. extreme value of Type I, the probability of a given household choice (f, m) is:

$$P^n(f, m; \vartheta) = \frac{\exp\{V(R(G(f), G(m), y^n), f, m; Z^n, \vartheta)\}}{\sum_{f\in\Omega}\sum_{m\in\Omega}\exp\{V(R(G(f), G(m), y^n), f, m; Z^n, \vartheta)\}}. \tag{3}$$

If (f^n, m^n) is the observed choice for the n-th household, the maximum likelihood estimate of ϑ is:

$$\vartheta^{ML} = \arg\max_{\vartheta} \sum_{n=1}^{N} \ln P^n(f^n, m^n; \vartheta). \tag{4}$$

4 Simulation design

Different empirical studies on labour supply have emphasized the importance of focusing on two margins of labour supply responses, which are the participation decision in the labour market—the extensive margin—and hours of work decision—the intensive margin (Heckman 1993).

Given the potential responses both at the intensive and extensive margin of older workers, it is crucial to analyse labour market decisions at both margins when alternative tax benefits systems are implemented. Saez (2002) shows that the application of NIT has a strong impact on labour supply responses at the intensive margin while at the extensive margin, tax-benefit systems such as in-work tax credits, are found to be the proper ones. Therefore the justification to implement a NIT is that this tax-benefit system is more appropriate when behavioural responses are concentrated along hours of work while in-work tax credit is a more suitable tax-benefit system when participation decisions matters.[20] This approach has very important policy implications because the older workers' decision at the extensive margin is influenced by the decision to retire while the decision at the intensive margin is limited by the lack of flexibility in hours of work. While in the USA, the application of NIT has produced adverse effects on labour supply participation decisions especially among those who received income support, in Europe the application of NIT had the purpose to redistribute toward zero or low-income earners (Moffit 2003).

[20] Negative Income Tax is based on the provision of a subsistence income level such that earnings above this level are normally taxed while those below it are entitled to receive benefits, which is otherwise called a "negative tax". The Negative Income Tax has been largely tested in the United States and was introduced by Friedman in 1962. Such a scheme provides the largest transfers to the lowest income earners who are presumably most in need of support.

The labour supply responses depend on the institutional features of the labour market. A higher flexibility at the intensive margin would allow the older workers to adjust their hours of work and weaken incentives to adjust the labour supply at the extensive margin. The increase of alternative working hours would result in a lower predisposition to shift into retirement because of more flexibility at the intensive margin. Nevertheless, due to fixed costs of work and the requirement to work a minimum number of hours per week, there is resistance toward the flexibility in labour supply.

Let us suppose we are interested in some alternative tax-transfer rule R_A. For a given choice (f, m), it will produce a net available income for the n-th household equal to $R(G(f), G(m), y^n)$. Let $P^n_{\mathrm{A}}(f, m; \vartheta^{\mathrm{ML}})$be the corresponding choice probability computed on the basis of the estimated parameter $\vartheta^{\mathrm{ML}}$and of the new tax-transfer rule. If we are interested in simulating the expected value of some function $\varphi^n(f, m)$, we simply compute:

$$E(\varphi^n(f,m)) = \sum_{f\in\Omega}\sum_{m\in\Omega}\varphi^n(f,m)P^n_A(f,m;\vartheta^{\mathrm{ML}}). \tag{5}$$

The simulation of different tax regimes consists in finding the tax rate, which equalizes the predicted net tax revenues under these tax regimes with net tax revenues that the state recovers from the current system. In what follows, we have simulated 4 different scenarios of tax-benefit systems that embody the above criterion. The first two reforms are based on a combination of a NIT (where a flat tax is complemented with a transfer that guarantees households' income up to a basic level) and a reduction in accrued pensions by 2.1 and 4.2% for each year of early retirement before the age of 65. Thus, taxes, benefits and pension reductions are simulated as follows:

$$\mathrm{Tax}_{\mathrm{NIT}} = \begin{cases} t_{\mathrm{NIT}}(Y - a * \mathrm{Poverty}) \rightarrow Y > a * \mathrm{Poverty} \\ o \rightarrow \mathrm{otherwise} \end{cases} \tag{6}$$

and the benefits as below:

$$\mathrm{Benefits}_{\mathrm{NIT}} = \begin{cases} a * \mathrm{Poverty} - Y \rightarrow Y \leq a * \mathrm{Poverty} \\ o \rightarrow \mathrm{otherwise} \end{cases}. \tag{7}$$

The poverty line is set equal to the median of gross income under the current system multiplied by a coefficient k, which takes several values ranging from 0.5 for households without children to 1.9 for those with not less than 2 children. Y refers to the gross income and t_{NIT} is a constant marginal tax rate. The parameter a is set equal to 0.5, 0.75, 1 and 1.25 and determines the generosity of the tax-transfer scheme such that the more generous the system, the higher is the parameter a. The guaranteed income replaces all current family benefits and transfers.

The next simulation is the application of WF, which essentially is a modification of NIT where the transfer is conditional on a minimum amount of weekly hours of work (e.g. a minimum of 20 weekly hours by one of the household members).[21]

[21] The WF is very similar to the NIT but the income support to households with gross income under the poverty line is given only if at least one of the partners work not less than 20 h per week. Workfare system is comparable to the recent reforms introduced in the US and the UK such as Earnings Tax Credit and In-work benefits. See Colombino et.al (2008).

Table 1 Conditinal Logit Estimates

Number of observation				11,484
LRchi2(36)				714.000
Prob > chi2				0.000
Log likelihood				−793.89188
Pseudo R2				0.3055
	Coeffecient	SE	*t* value	Significance
Income				
Costant	0.00685	0.001	5.53	***
Square	0.00000	0.000	−3.44	***
Age 55–60 female	0.00060	0.000	2.1	
Age 60–65 female	0.00122	0.000	3.15	**
Age 55–60 male	0.00121	0.000	4.83	***
Age 60–65 male	0.00211	0.001	4	***
Leisure female				
Costant	0.31617	0.073	4.35	***
Square	−0.00109	0.000	−3.39	***
Income	−0.00002	0.000	−3.2	***
Age 55–60	0.07553	0.014	5.56	***
Age 60–65	0.15277	0.026	5.81	**
Leisure male				
Costant	0.59265	0.066	9.02	***
Square	−0.00298	0.000	−10.66	***
Income	−0.00005	0.000	−6.98	**
Leisure female	−0.00109	0.000	−3.39	**
Age 55–60	0.06805	0.010	6.98	***
Age 60–65	0.14255	0.023	6.15	***

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

In all these simulations, the disposable income is a function of the wife and husband's earnings and other income. The systems of NIT and WF are interpreted as alternatives that try to compound the criterion of lessening distortions from high marginal tax rates and the criterion of redesigning the basic income support system in a more effective way. Different tax-benefit rules generate different impacts on the utility of the household, which are reflected by the changes in the levels of disposable income and leisure. Therefore a change in disposal income will indicate the change of welfare of the individual in monetary terms and a change in hours of leisure will indicate the effects on the labour supply and hours of work.

5 Conditional logit estimates and simulation results

The Conditional logit estimates (Table 1) indicate that the marginal utility of income is positive and decreasing either for leisure or income (the negative sign of the squared leisure and income). We also checked for the global concavity character of the utility function by calculating the first derivative of utility with respect to net

income and found that almost 88% of the sample satisfies the quasi-concavity conditions. The interaction term between income and leisure is negative and significantly different from zero implying that income is not separable from leisure. The preference for leisure significantly increases with age for both males and females. The interacted term between leisure of women and leisure of men is significantly negative implying that couples are less likely to share leisure time together probably due to the separateness of responsibilities and rights in the households (such as taking care for grandchildren or separate hobbies).

Table 2 Behavioural and welfare effects of the simulated reforms

	Average utility	Gini utility based	Average net income	Gini income based	Taxes	Benefits	Social welfare income based	Marginal tax	Average tax
Current	52.82	0.11	2,124	0.20	418	752	1,691		0.20
WF+ flat (2.1% per year)									
a = 0.50	53.04	0.11	2,424	0.25	232	608	1,817	0.13	0.10
a = 0.75	53.03	0.11	2,392	0.24	246	617	1,808	0.17	0.10
a = 1.00	53.00	0.11	2,335	0.23	273	636	1,791	0.23	0.12
a = 1.25	52.95	0.11	2,216	0.21	330	675	1,752	0.36	0.15
WF + flat (4.2% per year)									
a = 0.50	53.11	0.11	2,483	0.26	141	527	1,844	0.08	0.06
a = 0.75	53.11	0.11	2,465	0.25	150	533	1,841	0.10	0.06
a = 1.00	53.10	0.11	2,435	0.25	167	545	1,835	0.14	0.07
a = 1.25	53.08	0.11	2,381	0.23	197	567	1,828	0.20	0.08
NIT + flat (2.1% per year)									
a = 0.50	53.02	0.11	2,388	0.25	262	632	1,800	0.15	0.11
a = 0.75	53.00	0.11	2,324	0.24	298	659	1,777	0.21	0.13
a = 1.00	52.93	0.11	2,202	0.22	363	705	1,728	0.32	0.16
a = 1.15	52.83	0.11	2,018	0.19	452	766	1,642	0.48	0.22
NIT + flat (4.2% per year)									
a = 0.50	53.10	0.11	2,455	0.25	166	547	1,833	0.10	0.07
a = 0.75	53.09	0.11	2,415	0.25	192	567	1,821	0.13	0.08
a = 1.00	53.06	0.11	2,349	0.23	232	596	1,800	0.19	0.10
a = 1.25	53.00	0.11	2,213	0.21	304	648	1,756	0.33	0.14

NIT + flat (2.1%) is based on a combination of a NIT reform (where a flat tax is complemented with a transfer that guarantees households' income up to a basic level) and a reduction in accrued pensions by 2.1% for each year of early retirement before the age of 65. The same holds for WF + flat (2.1% per year) and so on

The Gini index is calculated using the Stata command relsgini and computes the Donaldson-Weymark relative S-Gini using the distributional sensitivity parameters specified in the parameter list. The average net income is calculated by subtracting the taxes and social insurance contributions from the sum of gross income and benefits. The average tax rate is calculated as the ratio between average taxes and average net income. The social welfare function income-based is equal to the product of the average income and the respective (1-Gini index)

Table 3 Percentage of winners by deciles Net Income based

Deciles	I–II	III–VIII	IX–X
WF + flat (2.1% per year)			
a = 0.50	50	100	88
a = 0.75	54	100	82
a = 1.00	63	100	76
a = 1.25	77	83	48
WF + flat (4.2% per year)			
a = 0.50	45	100	89
a = 0.75	51	100	88
a = 1.00	59	100	87
a = 1.25	73	100	80
NIT + flat (2.1% per year)			
a = 0.50	45	100	82
a = 0.75	53	100	68
a = 1.00	66	87	37
a = 1.15	72	25	8
NIT + flat (4.2% per year)			
a = 0.50	52	100	88
a = 0.75	58	100	81
a = 1.00	64	100	71
a = 1.25	75	81	43

As winners according to criterion we define all households with a post-reform income higher than that of the pre-reform utility

Next, we use the estimated parameters of the utility function to simulate the reforms described in the Sect. 4 and assess their effects on household labour supply behaviour and welfare (expressed in terms of income). The welfare reforms proposed in this study are intended to reduce the pension entitlement by a certain percentage and at the same time to provide all individuals in pre-retirement age with income up to a certain poverty threshold. The discussion concentrates on the following variables: average values of weekly working hours, average labour participation rates, disaggregation of working hours by gender, age and income deciles and lastly average retirement and unemployment/inactivity probabilities. As long as we modify only the labour supply behaviour of couples being in the age group 50–65 and not of the entire labour force, taking into consideration the tax rates yielded by the reforms would produce a partial assessment and not an appropriate comparison of the reforms. Therefore from now on we focus our discussion mainly on labour supply responses.

As shown in Table 2, most of the reforms perform better than the current system in terms of social welfare income-based index.[22] According to the social welfare criterion, the WF yields a higher value of welfare compared to the baseline scenario and NIT. Looking at the number of winners and losers (see Table 3), there are more

[22] We have tested four different levels of generosity level but our comments will disregard the highest level (1.25) as the simulated marginal tax rate exceeds the 50% level, which is the top marginal rate actually applied in Austria.

winners than losers for all reforms. The losers of these reforms come mainly from the upper and lower quintiles, respectively for the highest and the lowest generosity level. However the "winners" are absolutely concentrated among the middle quintiles and this is due to a higher labour supply elasticity of middle-income individuals.

Tables 4 and 5 illustrate the impact of the above reforms on labour supply at the intensive and extensive margin (average weekly hours and participation rates). In Table 4 we observe a clear increasing trend of male labour supply for all rules except for NIT where the highest generosity level applies. A slight increase of roughly 1 hour is observed for women, which however remains almost insignificant when compared to the effects on men. Looking at the generosity of welfare system, we notice that a moderate level of generosity would bring a higher response in labour supply at the intensive margin both under the tax-benefit system of WF and NIT. In addition, Tables 4 and 5 show that WF provides a higher response than NIT at both margins. This implies that when the participation decision in the labour market is a concern, the WF, which is a combination of moderate-income support along with lower replacement rates in early retirement, provides significant incentives for older workers to participate in the labour market.

Point estimates of labour supply do not help to get a complete picture of labour supply behaviour. Therefore, we disaggregate by age category and income deciles and show the estimates of the distribution of labour supply in Tables 6 and 7. Table 6 shows that the strongest responses in labour supply appear to be

Table 4 Labour Supply Behaviour (intensive margin)

	Male	Female
Curreent	24.03	13.25
WF + flat (2.1% per year)		
a = 0.50	27.91	14.38
a = 0.75	27.61	14.20
a = 1.00	27.07	13.89
a = 1.25	25.90	13.19
WF + flat (4.2% per year)		
a = 0.50	28.70	14.77
a = 0.75	28.56	14.67
a = 1.00	28.32	14.51
a = 1.25	27.90	14.19
NIT + flat (2.1% per year)		
a = 0.50	27.42	14.20
a = 0.75	26.69	13.85
a = 1.00	25.31	13.18
a = 1.15	23.21	12.15
NIT + flat (4.2% per year)		
a = 0.50	28.30	14.62
a = 0.75	27.86	14.41
a = 1.00	27.13	14.03
a = 1.25	25.69	13.23

Here the Intensive Margin captures labour supply responses in terms of average weekly hours

Table 5 Labour supply behaviour (extensive margin)

	Male	Female
Current	58.62	50.42
WF + flat (2.1% per year)		
a = 0.50	62.20	50.48
a = 0.75	62.03	51.59
a = 1.00	61.70	51.24
a = 1.25	60.91	50.40
WF + flat (4.2% per year)		
a = 0.50	63.15	52.55
a = 0.75	63.14	52.48
a = 1.00	63.14	52.38
a = 1.25	63.26	52.18
NIT + flat (2.1% per year)		
a = 0.50	61.37	51.37
a = 0.75	60.54	50.85
a = 1.00	58.99	49.87
a = 1.15	56.43	48.29
NIT + flat (4.2% per year)		
a = 0.50	62.47	52.20
a = 0.75	61.98	51.89
a = 1.00	61.29	51.43
a = 1.25	60.08	50.48

Here the Extensive Margin captures labour supply responses in terms of average participation rates

concentrated in the age category 55–60 both for men and women, but at a smaller amount in case of women. The lesser reaction among males younger than 55 is due to their high labour supply (close to full-time employment) compared to other age categories (close to part-time) whereas the lower labour response among the oldest individuals (60+) is due to their higher preference for leisure while reaching the official retirement age.[23] The disaggregation of labour supply by income deciles, as in Table 7, indicates that the highest responses are found among males belonging to the middle income group and to the last income deciles. Concerning low-income earners, they supply more hours of work with the increase in generosity level. A similar trend is observed also for women but at a smaller magnitude. To summarize, while among the mid and top deciles of income earners an increase in generosity level of income support is accompanied with labour disincentives, a reverse pattern is observed for low-income earners. These findings indicate that the labour supply response at the intensive margin increases with the rise of generosity level for those older workers clustered in the low-income deciles.

An interpretation of the above result is that lower average and marginal tax rates, available in-work benefits conditional on hours of work and low expected returns from early retirement due to the penalty, cause a higher substitution effect among middle- and low-income earners compared to high income deciles.

[23] This finding holds for both values of pension reductions (2.1 and 4.2%).

Table 6 Changes in labor supply disaggregated by age

Age	Male			Female		
	50–55	56–59	60–65	50–55	56–59	60–65
Current hours	35.60	17.79	2.51	19.72	5.51	1.45
WF + flat (2.1% per year)						
a = 0.50	1.95	6.43	2.61	1.10	1.44	0.84
a = 0.75	1.83	5.91	2.37	0.90	1.27	0.72
a = 1.00	1.55	5.02	2.01	0.54	0.99	0.53
a = 1.25	0.76	3.25	1.38	−0.32	0.40	0.22
WF + flat (4.2% per year)						
a = 0.50	1.66	8.43	3.43	1.32	2.25	1.29
a = 0.75	1.62	8.17	3.31	1.23	2.15	1.21
a = 1.00	1.52	7.73	3.17	1.05	2.00	1.08
a = 1.25	1.27	7.04	3.00	0.68	1.69	0.88
NIT + flat (2.1% per year)						
a = 0.50	1.72	5.58	2.32	0.92	1.19	0.73
a = 0.75	1.42	4.32	1.79	0.54	0.83	0.51
a = 1.00	0.68	2.07	0.86	−0.26	0.21	0.18
a = 1.15	−0.83	−1.00	−0.21	−1.59	−0.59	−0.15
NIT + flat (4.2% per year)						
a = 0.50	1.50	7.72	3.19	1.19	2.02	1.19
a = 0.75	1.37	6.90	2.84	0.98	1.75	1.03
a = 1.00	1.09	5.60	2.27	0.58	1.35	0.77
a = 1.25	0.30	3.30	1.25	−0.36	0.58	0.37

Changes in labour supply are expressed in average weekly hours

Furthermore we investigate how the simulated labour supply responses are translated across the retirement and unemployment/inactivity alternatives. Here, we distinguish between the concepts of "leisure" as a normal good related to unemployment/inactivity status, and the "retirement leisure" as a normal good consumed in the retirement status. Table 8 shows a decrease in the probabilities of retirement in case of men for all WF reforms and only for two NIT reforms (with lowest income-support generosity). What is really surprising is a higher simulated decrease in the retirement probabilities in case of women for all the reforms. Looking at the probabilities of being unemployed/inactive (Table 9), we notice again a similar trend as in case of retirement probabilities for men but a reversed trend for women which means that while men consume less "leisure" and "retirement leisure", women consume significantly less "retirement leisure" but more of normal "leisure". Thus, the huge income effect related to the unemployment/inactivity status outweighs the substitution effect related to the retirement status in case of women.

These different responses across retirement and unemployment/inactivity status signal that labour supply behaviour hide stronger, different responses across spells (retirement and unemployment/inactivity) and genders. The results related to decreasing trend in retirement probabilities are in line with Raab (2008) who shows

Table 7 Changes in labor supply hours by income deciles

Deciles	Male			Female		
	I–II	III–VIII	IX–X	I–II	III–VIII	IX–X
Current	10.16	38.59	23.88	5.84	18.93	13.86
WF + flat (2.1% per year)						
a = 0.50	1.20	7.60	3.55	0.10	2.32	1.07
a = 0.75	1.56	6.99	3.12	0.19	2.05	0.84
a = 1.00	2.21	5.81	2.39	0.34	1.54	0.43
a = 1.25	3.40	2.95	0.99	0.55	0.30	−0.39
WF + flat (4.2% per year)						
a = 0.50	1.82	8.15	4.48	0.17	2.57	1.62
a = 0.75	2.16	7.86	4.22	0.26	2.45	1.47
a = 1.00	2.78	7.31	3.79	0.42	2.21	1.22
a = 1.25	3.95	6.18	3.07	0.66	1.71	0.77
NIT + flat (2.1% per year)						
a = 0.50	0.76	7.11	3.03	−0.02	2.15	0.87
a = 0.75	0.81	5.95	2.20	0.00	1.67	0.45
a = 1.00	1.02	3.33	0.68	0.04	0.58	−0.33
a = 1.1	1.22	−1.15	−1.39	0.04	−1.29	−1.42
NIT + flat (4.2% per year)						
a = 0.50	1.39	7.82	4.07	0.06	2.47	1.44
a = 0.75	1.42	7.21	3.52	0.08	2.22	1.16
a = 1.00	1.63	6.01	2.62	0.15	1.71	0.68
a = 1.25	2.32	3.00	0.99	0.26	0.42	−0.26

that Austrians respond much stronger to changes in financial incentives (a la Gruber and Wise) than older workers in other countries but unlike in most other countries, women respond stronger to accrual incentives than men.[24] However, this is at odds with Gruber and Wise (2004) findings that men should respond stronger to financial incentives than women due to their higher contribution in the household income. As Raab (2008) mentions, Austria is a special case as far as the retirement age for women is concerned. Here we need to consider also the fact that retirement decisions within couples might be simultaneously taken. Zweimuller et al. (1996)

[24] Gruber and Wise (2004) show that social security incentives have a strong impact on retirement decisions which is similar in countries with very different cultural histories, labor market institutions, and other characteristics. The main variables used to measure the social security incentives are the social security wealth (SSW, the present discounted value of the sum of expected future pension benefits) and the accrual in social security wealth (ACC, the difference in social security wealth by postponing retirement by one year). Under an actuarially fair pension system, the probability of retirement should be an increasing function of the SSW and a decreasing function of the ACC. The incentive effect that social security may have on the retirement decisions of the old workers can be split up into an income effect (under the rational that leisure is a normal good, one would consume more of it if a higher value of SSW is excepted) and a substitution effect (a positive value of ACC induces individuals to postpone the retirement decision by one year and consequently consume more leisure). The effects of the ACC on the retirement decisions are significantly negative both for men and women.

Table 8 Simulated retirement probabilities

	Male	Female
Current	0.325	0.204
WF + flat (2.1% per year)		
a = 0.50	0.300	0.186
a = 0.75	0.301	0.185
a = 1.00	0.303	0.183
a = 1.25	0.307	0.179
WF + flat (4.2% per year)		
a = 0.50	0.294	0.180
a = 0.75	0.294	0.179
a = 1.00	0.293	0.177
a = 1.25	0.291	0.173
NIT + flat (2.1% per year)		
a = 0.50	0.305	0.187
a = 0.75	0.310	0.187
a = 1.00	0.320	0.186
a = 1.15	0.336	0.185
NIT + flat (4.2% per year)		
a = 0.50	0.298	0.181
a = 0.75	0.301	0.180
a = 1.00	0.304	0.179
a = 1.25	0.309	0.175

study the possibility of interdependent retirement in Austria and show that husbands react to changes in wives' legal minimum retirement age while wives don't. They explain this asymmetry by making special assumptions with respect to the income and substitution effects or the bargaining process within couples. In a traditional family, the husband may retire latter if his wife postpones her retirement while the wife may retire regardless the husband's labour market participation status. This might be the case for the couples in our sample where the husband postpones the early retirement and the wife enjoys her "leisure" under the unemployment/inactivity status. Therefore, a reduction in household' disposable income due to pension penalties, might induce the husband rather than the wife to work longer.

6 Conclusion

By means of a micro-econometric model of household labour supply, we have simulated the ex-ante effects of some reforms, which are a mixture of a future prospect of pension reductions and an income support for the low-income households in Austria. In particular, these reforms are based on the combination of either a NIT or WF and a reduction of pensions by 4.2 and 2.1% in line with the pension reforms 2003–2004 and 2007. We find that most of these reforms bring higher social welfare compared to the baseline system, especially WF that is

Table 9 Simulated Unemployment and inactivity probabilities

	Male	Female
Current	0.089	0.292
WF + flat (2.1% per year)		
a = 0.50	0.078	0.296
a = 0.75	0.079	0.299
a = 1.00	0.080	0.305
a = 1.25	0.084	0.317
WF + flat (4.2% per year)		
a = 0.50	0.074	0.295
a = 0.75	0.075	0.297
a = 1.00	0.075	0.299
a = 1.25	0.076	0.305
NIT + flat (2.1% per year)		
a = 0.50	0.081	0.299
a = 0.75	0.085	0.304
a = 1.00	0.091	0.316
a = 1.15	0.099	0.332
NIT + flat (4.2% per year)		
a = 0.50	0.077	0.297
a = 0.75	0.079	0.301
a = 1.00	0.083	0.307
a = 1.25	0.090	0.320

characterized by an approach of moderate generosity of income support while working and lower pension entitlement in case of early retirement.

We find that the proposed reforms produce important labour incentives to middle-income men in the age category 55–60 whereas the effects for women are weaker. However, when we investigate how labour supply responses differ across the retirement and unemployment/inactivity alternatives, we surprisingly find that these reforms have an increasing effect on unemployment/inactivity probabilities but a decreasing effect on the retirement probabilities in case of women. Furthermore, as the income effect related to the unemployment/inactivity status outweighs the substitution effect related to the retirement status, female labour supply appeared to be slightly affected in overall. These different responses across retirement and unemployment/inactivity status signal that labour supply behaviour hide stronger and different responses across spells for both genders and with different magnitude.

Therefore, reforms that penalise pension benefits along with an income support provided to low-income households seem to be effective in encouraging labour supply and postponing early retirement among couples at preretirement age but may also lead the women to get locked in the unemployment/inactivity trap.

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Appendix 1

See Appendix Box 1, Tables 10, 11, 12, 13 and 14.

Box 1 Parametric reforms in Austria (2003)

2003: Budgetbegleitgesetz 2003	2004: Pension Harmonisation (proposal)
Reduction of pension calculation coefficient (Steigerungsbetrag) from 2% per pension year to 1.78% (the level of pre-1997) phased in over five years	Creation of a single pension system mandatory for all workers under the age of 50
Pension adjustment according to prices for 2003 and 2004	Retirement age at 65 (for males and females from 2033 onward);
Revamped Bonus/Malus system	Creation of a 'pensions corridor' that will allow early or late retirement between the ages 62 and 68; early retirement will incur an annual actuarial deductions, late retirement will incur an annual bonus of 4.2%
Bonus increased from 3 to 4.2% of pension calculation coefficient	Introductions of NDC pension accounts
Malus increased from 0.4% of Steigerungsbetrag to 4.2% of gross pension	Contributions
Increase of calculation basis from 15 to 40 years over a 25 year period	White- and blue-collar workers, civil servants: 22.8%
Abolition of early retirement; increase earliest possible retirement age by 2 months per quarter from second half of 2004	Self-employed: 17.5%
Extension of Altersteilzeit: Eligibility 5 years before earliest possible retirement age; will increase in line with retirement age	Farmers: 15%
Abolition of early retirement based on unemployment; replaced by Altersübergangsgeld (unemployment benefit)	Replacement rate will be 80% of average life earnings at the age of 65 after 45 years of paying contribution (the '65-45-80' formula)
Incentives for employing/retaining older workers (abolition of unemployment contributions for older workers)	Extension of exceptions for certain class of workers (Haklerregelung) until 2010
Claim to qualification of older (and younger) unemployed; claim for receiving further education and training	Creation of a permanent exception for hard and dangerous manual labour to cover no more than 5% of the working population(Schwerarbieterregelung)
Possibility to work and receive pension; earned income during pension will result in a higher pension	Annual pension adjustment according to price index

Box 1 continued

2003: Budgetbegleitgesetz 2003	2004: Pension Harmonisation (proposal)
Increases in non-contributory benefits for women in line with changes to family benefits	Introduction of a "sustainability factor" into the pension formula that adjusts benefits according to developments in life-expectancy
Workers with very long contribution histories (40/45 contribution years) or workers that operate in physically abrasive work environment will still be able to retire early (the so-called Hacklerregelung)	Transition via parallel calculation
Measures to assist people with very low pensions	
Limitation of pension cuts for each individual to 10%	

Source: Ney (2004), page 16

Table 10 Pensions as percentage of GDP in 2004

	EU15	Austria
Total	12.03	14.03
Old age pension	9.04	11.02
Anticipated old age pension	0.05	1
Partial pension	0	0
Disability pension	1.02	1.04
Early retirement benefit due to reduced capacity to work	0	0.03
Survivors' pension	1.01	0.04
Early retirement benefit for labour market reasons	0.01	0.01

Table 11 Expenditures as percentage of GDP in 2004

	EU15	Austria
Total expenditure	27.06	29.01
Social protection benefits	26.06	28.03
Administration costs	0.09	0.05
Other expenditure	0.02	0.04
Sickness/health care	7.05	7.01
Disability	2.01	2.03
Old age	10.09	13.03
Survivors	1.02	0.04
Family/children	2.01	3
Unemployment	1.08	1.07
Housing	0.05	0.01
Social exclusion	0.04	0.04
Sickness and disability	9.07	9.04
Old age and survivors	12.02	13.06
Housing and Social exclusion	0.09	0.05

Source: Eurostat (2004)

Table 12 Austrian Economically Inactive Population by Reason for Inactivity in 2006

		All reasons	Retirement
Both sexes	50–64	685,100	495,900
	65+	1,272,600	1,183,500
Female	50–64	415,200	267,100
	65+	759,700	674,400
Male	50–64	269,900	228,800
	65+	512,800	509,000

Source: UNECE Statistical Division Database, compiled from national official sources

Table 13 Earning equation for men and women (regression model with sample selection)

	Women		Men	
	Coef.	Std	Coef.	Std
Wage equation				
Education	0.0407	0.0094***	0.0293	0.0121*
Experience	0.0307	0.0045***	0.0321	0.0057***
Experienced	−0.0002	0.0001	−0.0002	0.0001
Region2	−0.0269	0.0522*	−0.0573	0.0721
Region3	−0.1032	0.0474	−0.0085	0.0689
Region4	−0.0237	0.0617	−0.0746	0.0920
Region5	−0.0163	0.0480	0.0327	0.0691
Region6	0.0290	0.0612	0.0165	0.0822*
Region7	0.0157	0.0557	0.0909	0.0813
Region8	0.0175	0.0673	0.0149	0.0892
Region9	−0.0867	0.0482	−0.0085	0.0707
Armed forces	0.2699	0.1146*	−0.0272	0.3971
Senior officials and management	0.3837	0.0700***	0.2295	0.1479
Professionals	0.3163	0.0667***	0.3230	0.0971***
Technicians and associate professionals	0.3978	0.0516***	0.1721	0.1026
Clercks	0.3279	0.0505***	0.0792	0.0826
Service and sales workers	0.1195	0.0484*	−0.0909	0.0816
Skilled agricultural	−0.4179	0.1080***	−0.7700	0.1601***
Craft and trades workers	0.1401	0.0478**	0.0106	0.1147
Plant and machine operators	0.1777	0.0582**	0.0832	0.1695
Cohabitating	0.3778	0.0739***	0.0921	0.0321**
Constant	1.6135	0.1268***	1.8927	0.1781***
Selection equation				
Married	−0.0288	0.0757	−0.1100	0.0673
Cohabitating	0.1958	0.0785*	0.0514	0.0697
Years of contributions	−0.0312	0.0020***	−0.0187	0.0019***
Education	0.0547	0.0132***	0.0496	0.0120***
Regional unemployment	−4.0340	0.9466***	1.6381	1.3752
Constant	0.5566	0.1651***	−0.1500	0.1627***
/athrho	−1.6204	0.0523***	−1.7237	0.0502***

Table 13 continued

	Women		Men	
	Coef.	Std	Coef.	Std
/lnsigma	−0.3637	0.0191***	−0.0649	0.0223**
Rho	−0.9247	0.0076	−0.9383	0.0060
Sigma	0.6951	0.0133	0.9372	0.0209
Lambda	−0.6427	0.0158	−0.8794	0.0234
Number of observations	3,320		3,349	
Censored	1,250		1,714	
Uncensored	2,070		1,635	
Log likelihood	−3419.237		−3580.56	
LR test of independent equations chi2(1)=	349.32		390.83	
Wald chi2(21)	609.86		325.88	

* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$

Table 14 Pension entitlement equation for men and women (regression model with sample selection)

	Men		Women	
	Coef.	Std.	Coef.	Std.
Pension entitlement				
Wage	1.7344	0.320****	1.1718	0.379**
Contributions	0.0202	0.007**	0.0418	0.006***
Region1	0.6409	0.192***	−0.0021	0.185
Region2	0.4124	0.181*	−0.1390	0.170
Region3	0.2708	0.233	−0.2112	0.235
Region4	0.2585	0.181	−0.1080	0.176
Region5	0.5018	0.221*	0.0022	0.243
Region6	0.4017	0.199*	−0.1740	0.197
Region7	0.2647	0.220	−0.5807	0.237*
Region8	0.4882	0.185**	−0.1782	0.181
Constant	2.9872	0.978**	3.7825	1.098***
Retirement equation				
Married	−0.0146	0.083	−0.0336	0.072
Income from self employment	−0.0001	0.000***	0.0001	0.000
Property Income	−0.0001	0.000	0.0003	0.000
Income from investment	0.0003	0.000	−0.0003	0.000
Education	−0.0221	0.022	0.0030	0.019
Private pension	−0.0002	0.000**	−0.0001	0.000*
Regional unemployment	2.4188	1.861	1.2010	1.680
Size of household	−0.0875	0.033**	−0.1207	0.039**
Constant	−0.3906	0.273	−0.2540	0.234
/athrho	−2.0357	0.179***	−1.7476	0.171***

Table 14 continued

	Men		Women	
	Coef.	Std.	Coef.	Std.
/lnsigma	−0.2412	0.075**	0.0919	0.065
Rho	−0.9665	0.012	−0.9411	0.020
Sigma	0.7857	0.059	1.0963	0.071
Lambda	−0.7593	0.064	−1.0317	0.085
Number of observations	1,004		961	
Censored	844		691	
Uncensored	160		270	
Log likelihood	−600.2632		−938.6954	
LR test of independent equations chi2(1)=	47.94		31.06	
Wald chi2(10)	47.67		64.5	

Appendix 2: Prediction of earnings

Table 13 shows that labour market participation is lower for males with longer contributory period and residing in regions with high unemployment rates, while it is higher for those who are more educated and cohabitate. As for females, labour market participation is lower for those women with more years of contribution and is higher for the more educated ones. These features of labour supply behaviour reflect the attitudes of the working force close to the retirement phase. The estimates of earning equation show a significant and positive effect of education, experience and cohabitating status for both men and women pointing out that earnings possibilities improve with the increase of experience and higher education as shown in the human capital theory and labour market signalling.

Appendix 3: Prediction of pension entitlements

The Heckman selection model helps to predict the pension's entitlement in case this alternative is not chosen by the individual. The imputation takes place as follows:

(a) first we estimate the propensity to retire early based on a vector of characteristics $\Phi(\lambda^{'} Z_{Pt}) = \text{Prob}(\varepsilon_{pt} > -\lambda^{'} Z_{Pt})$ where Z_{Pt} is a vector of characteristics, λ is a vector of parameters and ε_{pt} is a standard normal random variable

(b) Pension entitlements specification used in this paper is based on a similar specification used by Colombino (2003). Pensions received at a certain time t depend on the initial value of pension after τ years of employment,

$$P_t(\tau) = A_\tau \vartheta \Psi(R_\tau, R_{\tau-1}, \ldots, R_{\tau-n}) \tau e^{\rho(t-\tau)} \xi_{Pt} \tag{8}$$

$$\text{where } \Psi(R_t, R_{t-1}, \ldots, R_{\tau-n}) = \frac{\sum_{i=0}^{n} R_{\tau-i}}{n+1}$$

- $\vartheta\Psi$ (R_τ,$R_{\tau\text{-}1}$, … $R_{\tau-n}$) represents the proportion ϑ of the average employment earnings over the last $n + 1$ years
- τ represents the number of years of being employed (seniority)
- $A_\tau = 1$ when the individual is eligible for early retirement pension and 0 otherwise
- ρ represents the annual rate of increase of the pension
- ξ_{Pt} is the stochastic component assumed to follow a lognormal distribution

If we ignore the stochastic component, we get

$$\Psi(R_t, R_{t-1}, \ldots, R_{\tau-n}) = R_\tau \sum_{i=0}^{n} \frac{e^{-i}}{n+1}. \tag{9}$$

And therefore, the Eq. 8 can be expressed in a logarithmic way as follows:

$$\ln(P_t(\tau)) = \ln(\vartheta) + \ln\left(\sum_{i=0}^{n} \frac{e^{-i}}{n+1}\right) + \ln(R_\tau) + \ln(\tau) + \rho(t-\tau) + \ln(\xi_{Pt}) \tag{10}$$

where ln (R_τ) represents labour income calculated using the Heckman selection regression for earnings (Table 13).

(c) Summing up the Eq. 10, we need to estimate the following equation on the sample of early retired individuals.

$$E(\ln(P_t)) = \eta' \text{Region} + \ln(R_\tau) + \ln(\tau) + \rho(t-\tau) + \frac{\text{cov}(\ln(\xi_{\text{Rt}})\text{n}(\xi_{\text{Pt}}))\phi(\lambda' Z_{\text{PT}})}{\sqrt{n(\xi_{\text{Pt}})} \quad \Phi(\lambda' Z_{\text{PT}})}. \tag{11}$$

As P_t represents the pension that the individual would receive at time t if he had to retire at the same time, t equals τ and therefore the term $\rho(t - \tau)$ cancels out.[25]

We include in the vector Z_{PT} the following characteristics variables:

1. Education
2. Married or not
3. Income from self-employment
4. property income
5. income from investment
6. private pension
7. regional unemployment

Table 14 shows the estimates of the pension entitlement counting for the Heckman selectivity. The pension entitlements increase with wages and the number of contribution both for men and women. Income from self-employment and holding a private pension seem to be important for the retirement decision. In addition, the lack of job possibilities (signalled by a high unemployment rate) makes

[25] We tried to insert the dummy variables of being self-employed or working in the public sector as in Colombino (2003) but it turned out to be insignificant.

the retirement option more attractive. Lastly, the decision to opt for the retirement decision is more likely for those couples coming from small size households.

Appendix 4

A. Utility function specification

The specification is linear-in-parameters, which allows the use of potential estimation procedures available in most econometric or statistical packages. We chose a quadratic specification since it represents a good compromise between flexibility and ease of estimation:

$$V(X, h_F, h_M; b) = b_x X + b_F(T - h_F) + b_M(T - h_M) + b_{xx}X^2 + b_{FF}(T - h_F)^2 + b_{MM}(T - h_M)^2 + b_{xF}X(T - h_F) + b_{xM}X(T - h_M). \quad (12)$$

Some of the above parameters b_s may depend on household or individual characteristics Z. A convenient choice might be to interact the disposable income and the leisure variables with the individual characteristics as follows:

$$b_F = b_{F1}(G\_60_{\text{wife}}) + b_{F2}b_{F1}(G\_65_{\text{wife}})$$
$$b_M = b_{M1}(G\_60_{\text{husband}}) + b_{M2}(G\_65)$$
$$b_x = b_{x1}(\text{Age}_{\text{husband}}) + b_{x2}(\text{Age}_{\text{wife}}).$$

B. Choice set specification and hours distribution

The choice set is composed of 6 alternatives for each individual by specifying the interval of hours of work and sample randomly within this interval which has a length of 16 h. The first alternative refers to zero hours of work, and the last to the pension choice. The actual observed hours will be rounded to the closest discrete value. The basic idea can be appropriately modified when one directly observes annual hours or weeks worked.

To capture the effect of each alternative on the utility, we use some alternative dummies and calling them with a common variable A, we express the probability function as follows:

$$P^n(f, m; \vartheta) = \frac{\exp\{\Psi^n(f, m; \vartheta) + \gamma A\}}{\sum_{f\in\Omega}\sum_{m\in\Omega}\exp\{\Psi^n(f, m; \vartheta) + \gamma A\}} \quad (13)$$

where the γs are parameters to be estimated.

The dummies can be interpreted as reflecting quantity constraints on the labour market (as in Aaberge et al. 1999) or specific utilities of full-time, part-time, extra-time jobs or maybe both (as in Van Soest and Das 2001, 2002).[26]

[26] Van Soest and Das (2001) use a different mechanism to account for "peaks and holes" in observed hour distribution, namely fixed cost of working. This leads, however, to a more complicated estimation and therefore we would not advise the adoption of this procedure in the basic model estimation.

The simulations are run under a neutral budget provided that this age group is treated differently from the others in terms of tax rates.

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