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Pension system, unemployment insurance and employment at older ages in Finland

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Pension system, unemployment insurance and employment at older ages in Finland[1]

Tuulia Hakola[*] and Niku Määttänen[**]

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Abstract

We analyse the labour supply and retirement incentives of the Finnish social security system with a numerical life cycle model with endogenous labour supply and retirement decisions. The model features a detailed description of the benefit rules of the pension and unemployment insurance systems and takes into account various early retirement options. Our main aim is to find policy reforms that would postpone labour market withdrawals and reduce the fiscal cost of the social security system without having too regressive distributional effects.

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Pension system, unemployment insurance, labour supply

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Tutkimuksessa tarkastellaan Suomen sosiaaliturvajärjestelmän työn tarjontaan ja eläkkeelle jäämiseen liittyviä kannustimia. Analyysissa käytetään numeerista elinkaarimallia, jossa työntarjontaan ja eläkkeelle jäämiseen liittyvät päätökset riippuvat yksilöiden valinnoista. Malli sisältää Suomen eläke- ja työttömyysturvajärjestelmän yksityiskohtaisen kuvauksen ja ottaa myös huomioon erilaiset varhaisen eläkkeelle siirtymisen vaihtoehdot. Keskeinen tutkimusongelma on identifioida politiikkatoimenpiteitä, jotka myöhentäisivät eläkkeelle siirtymistä ja vähentäisivät sosiaaliturvan rahoitustarvetta kasvattamatta kuitenkaan tuloeroja.

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I undersökningen granskas incitamenten i det finländska systemet för social trygghet när det gäller arbetsutbud och pensionering. Analysen tillämpar en numerisk livscykelmodell, där beslut som gäller arbetsutbud och pensionering beror på personliga val. Modellen innehåller en detaljerad beskrivning av det finländska pensionssystemet och systemet med utkomstskydd för arbetslösa och den beaktar också olika former av tidig pensionering. Ett centralt problem är att kunna identifiera sådana politiska åtgärder som fördröjer pensioneringen och minskar behovet av finansiering av social trygghet utan att öka inkomstskillnaderna.

Nyckelord
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PREFACE

Ageing has been on the Finnish policy agenda for years and several important reforms have already been implemented, the most significant having been the pension reform of 2005.

In 2004, Matti Vanhanen's first Government issued a future report on population ageing, population policy and preparation for the consequences of ageing. The future report committed the Government to following the situation and the effectiveness of the implemented policies. The Programme of Matti Vanhanen's second Government lays down that the sufficiency of policies shall be assessed in a way that allows possible additional measures to be taken during the Government's term.

With reference to the above commitments, the Prime Minister assigned the Secretariat of the Economic Council to produce an overall analysis of ageing policies in Finland. The objective was to update key demographic trends and carry out an overall assessment of the implications of population ageing, of the policies implemented and outlined and of the need of further policy action.

The Secretariat commissioned several studies from outside experts to contribute to the analysis. A key issue in ageing policy concerns the incentives created by tax and benefit systems that promote ageing workers' participation in the labour market: How should the existing benefit and tax systems be reformed in order to obtain the best possible employment outcomes with reasonable distributional and budgetary impacts?

To analyse this issue in the Finnish institutional context, a study was commissioned from the Research Institute of the Finnish Economy. The study conducted by Dr. Tuulia Hakola and Dr. Niku Määttänen extends a numerical life-cycle model of theirs and, using this model, examines the implications of a number of policy reforms. The results are extremely interesting, and in part even somewhat unexpected. The findings concerning the early retirement schemes have substantially influenced the policy conclusions of the final report.

I wish to extent my warmest thanks to the authors and Research Assistant Iiris Koskela-Näsänen, who took care of finalising the report for printing.

Vesa Vihriälä
Secretary General of the Economic Council

CONTENTS

TIIVISTELMÄ

Suomen sosiaaliturvajärjestelmään on viime vuosina tehty useita uudistuksia, joiden tavoitteena on ollut työurien pidentäminen. Erityisesti varhaista eläkkeelle siirtymistä on pyritty vähentämään. Ikääntyneiden – 55–65-vuotiaiden – työllisyysaste onkin noussut nopeasti. Ikääntyneiden työllisyys on silti Suomessa edelleen selvästi matalampi kuin nuorempien ihmisten ja myös matalampi kuin ikääntyneiden työllisyys useimmissa muissa pohjoismaissa.

Tässä tutkimuksessa tarkastellaan kolmentyyppisiä uudistuksia, joiden kaikkien tavoitteena on ikääntyneiden työllisyysasteen nostaminen. Yksi ryhmä uudistuksia liittyy nykyisten varhaiseläkejärjestelmien rajoittamiseen. Tarkastelemme niin sanottua työttömyysputkea, eli oikeutta jatkettuun ansiosidonnaiseen työttömyyskorvaukseen ikävuoden 57 jälkeen sekä osa-aikaeläkettä. Toinen ryhmä uudistuksia koskee vanhuuseläkkeen ikärajoja. Työuria voidaan pyrkiä pidentämään poistamalla oikeus varhennettuun varhaiseläkkeeseen 62-vuotiaana tai siirtämällä 63 vuoden vanhuuseläkeikää eteenpäin. Kolmas ryhmä uudistuksia liittyy verotukseen. Ikääntyneiden työllisyysastetta voidaan yrittää lisätä verottamalla kaikkien ikääntyneiden palkkatuloja muita kevyemmin tai keventämällä niiden tuloverotusta, jotka saavat yhtä aikaa sekä eläkettä että palkkatuloa.

Arvioimme edellä kuvattuja uudistuksia sellaisen elinkaarimallin avulla, joka kuvaa työntarjonta- ja eläkkeelle siirtymispäätöksiä. Mallimme sisältää tarkan kuvauksen eläkkeiden määräytymistä koskevista säännöistä Suomen yksityisen sektorin lakisääteisessä työeläkejärjestelmässä. Mallissa on myös kansaneläke, progressiivinen ansiotuloverotus ja ansiosidonnainen työttömyyspäiväraha, työmarkkinatuki ja peruspäiväraha. Malliin liittyvä palkkaprosessi on estimoitu suomalaisen aineiston perusteella. Yksilöiden päätösten taustalla olevat ns. hyötyparametrit on valittu siten, että mallin yksilöt käyttäytyvät ennen uudistusta voimassa olevien eläkesääntöjen vallitessa mahdollisimman samalla tavalla kuin ihmiset tilastojen mukaan tekevät. Malli kuvaa yksinomaan työn tarjontaa ja ihmiset voivat mallissa aina halutessaan tehdä palkkatyötä. Työstä maksettava palkka voi kuitenkin jäädä hyvin matalaksi.

Erilaisia uudistuksia koskevat tuloksemme perustuvat siihen, että muutamme mallissa eläke-, työttömyysturva- tai verojärjestelmän sääntöjä ja tarkastelemme, miten mallin yksilöiden käyttäytyminen muuttuu. Arvioimme uudistuksia kolmella eri kriteerillä: Miten ne vaikuttavat työntarjontaan, miten ne vaikuttavat julkiseen talouteen ja minkälainen tulonjakovaikutus niillä on. Tulonjakotarkastelu on tärkeätä erityisesti varhaiseläkejärjestelmiä rajoittavien uudistusten yhteydessä. Vertaamme myös yksittäisten ihmisten käyttäytymistä ennen ja jälkeen uudistuksen. Tällainen tarkastelu auttaa ymmärtämään miten uudistukset vaikuttavat erilaisissa taloudellisissa tilanteissa olevien ihmisten valintoihin.

Arvioiduista uudistuksista työttömyysputken poistaminen lisää eniten ikääntyneiden työllisyyttä. Työttömyysputken poistaminen parantaa myös julkisen talouden kestävyyttä työttömyysturvamenojen vähentymisen ja palkkaverotulojen lisääntymisen kautta.

Työttömyysputken poistamisella on kuitenkin kielteisiä tulonjakovaikutuksia. Osittain työttömyysturvajärjestelmään liittyvän progression vuoksi työttömyysputkea hyödyntävät erityisesti ihmiset, joiden ansiomahdollisuudet ovat suhteellisen huonot. Tarkastelimme myös uudistusta, jossa jatketun ansiosidonnaisen työttömyyspäivärahan menetys korvataan oikeudella saada työmarkkinatukea yhtä aikaa palkkatulojen kanssa. Ajatuksena on kannustaa ikääntyneitä työpaikkansa menettäneitä ihmisiä ottamaan vastaan heidän aikaisempaa työtään selvästi huonomminkin palkattua työtä ja samalla kompensoida tulotason aleneminen ainakin osittain työmarkkinatuen suuruisen tulonsiirron avulla. Tällainen hieman pehmeämpi uudistus tuottaa lähes saman työllisyysvaikutuksen kuin pelkkä työttömyysputken poistaminen. Julkisen talouden säästöt jäävät kuitenkin paljon pienemmiksi verrattuna uudistukseen, jossa vain poistetaan oikeus jatkettuun ansiosidonnaiseen päivärahaan.

Myös osa-aikaeläkkeen poistaminen tai pienentäminen lisää ikääntyneiden työllisyyttä ja parantaa julkisen talouden kestävyyttä. Työllisyys lisääntyy kuitenkin paljon vähemmän kuin jos työttömyysputki poistettaisiin. Tämä johtuu kahdesta seikasta. Ensinnäkin, osa-aikaeläkettä nauttii vähemmän ihmisiä kuin jatkettua ansiosidonnaista päivärahaa. Toiseksi, osa-aikaeläke subventoi paitsi osa-aikatyötä suhteessa kokopäivätyöhön, myös osa-aikatyötä suhteessa työttömyyteen. Osa-aikaeläkkeen poistaminen lisää täyspäivätyöllisyyden lisäksi myös työttömyyttä ja erityisesti työttömyysputken käyttöä.

Osa-aikaeläkkeen poistamisella on suurempi työllisyysvaikutus, jos työttömyysputkea samalla rajoitetaan. Tämä tulos heijastaa sitä, että työttömyysputki on mallin perusteella monelle osa-aikaeläkeläiselle toiseksi houkuttelevin vaihtoehto.

Tutkimuksen mukaan osa-aikaeläke houkuttelee erityisesti ihmisiä, joilla on suhteellisen hyvä ansiotaso. Tämä liittyy siihen, että toisin kuin työttömyysturvan korvausaste, osa-aikaeläkkeen suhde ansiotasoon ei vähene ansioiden kasvaessa. Nykyistä, taloudellisesti varsin houkuttelevaa osa-aikaeläkejärjestelmää on vaikea perustella tulonjakotavoitteella.

Pelkästään vanhuuseläkkeen ikärajaa nostamalla ei tulosten perusteella pystytä lisäämään työn tarjontaa. Ikärajan nostaminen näkyisi lähinnä työttömyysputken ja osa-aikaeläkkeen käytön lisääntymisenä. Lisäksi on huomattava, että työeläkejärjestelmä ei nykyisellään erityisesti heikennä työnteon kannustimia ikävuoden 63 jälkeen. Halutessaan ihmiset voivat työskennellä 63-vuoden vanhuus-

eläkeiän jälkeen ja joko nostaa aikaisemmin kertynyttä eläkettään yhtä aikaa palkkatulon kanssa tai lykätä eläkkeen nostamista hyödyntäen niin sanottua superkarttumaa.

Tämä tulos ei tarkoita, ettei vanhuuseläkkeen ikärajaa tarvitse koskaan nostaa. On mahdollista, että ikääntyneiden ihmiset tulevaisuudessa haluavat tehdä yhä pidempiä työuria yleisen eliniän kasvun myötä. Myös ikääntyneiden ihmisten työkyky ja ansiomahdollisuudet todennäköisesti edelleen paranevat. Jos näin tapahtuu, niiden ihmisten lukumäärä, jotka joko nostavat eläkettä ansiotyössä olleessaan tai hyödyntävät superkarttumaa kasvaa. Pidemmän päälle tämä tulee eläkejärjestelmän kannalta kalliiksi. Tällöin voi olla syytä korottaa eläkkeen nostamiseen ja superkarttumaan liittyvää ikärajaa.

Tuloverotuksen osalta tarkastelemme kahta uudistusta. Ensimmäisessä uudistuksessa kaikkien yli 63-vuotiaiden ansiotuloverotusta kevennetään 10 prosenttia. Toisessa uudistuksessa alennus annetaan vain niille, jotka saavat yhtä aikaa eläke- ja palkkatuloa. Ensimmäinen uudistus lisää työntarjontaa ja on samalla fiskaaliselta vaikutukseltaan lähes neutraali: Lisääntyneestä työnteosta tulo- ja kulutusverotuksen kautta tuleva verokertymä korvaa tuloverotuksen keventämisestä aiheutuvat veromenetykset. Toinen uudistus hieman yllättäen vähentää hieman työntarjontaa. Tulos selittyy sillä, että uudistuksen seurauksena osa ihmisistä alkaa tehdä osa-aikatyötä täyspäivätyön sijaan. Vastaavasti tämä toinen uudistus myös vähentää verotuloja selvästi.

Yleisemmin nämä verouudistuksia koskevat tuloksemme osoittavat, että huolellisesti suunnitellulla verouudistuksella saattaa olla mahdollista alentaa ikääntyneiden verotusta ilman, että se juuri vähentää verotuloja. Tämä perustuu siihen, että ikääntyneiden ihmisten työntarjontajousto on paljon suurempi kuin nuorempien. Tämä puolestaan johtuu lähinnä siitä, että monilla ikääntyneillä on esimerkiksi osa-aikaeläkkeen ja vanhuuseläkkeen vuoksi olemassa suhteellisen edullinen mahdollisuus vähentää työntekoa tai vetäytyä kokonaan pois työelämästä. Ikääntyneiden työn verotuksen keventäminen voi tehdä työuran jatkamisesta monen kohdalla ratkaisevasti houkuttelevamman vaihtoehdon. Veronalennuspolitiikkaan liittyy kuitenkin vaaroja. Jotta veronalennukset rahoittaisivat itse itsensä, ne on suunnattava riittävän vanhoille ihmisille. Lisäksi on huolehdittava siitä, että veronalennus ei tee esimerkiksi osa-aikaeläkkeestä aikaisempaakin houkuttelevampaa vaihtoehtoa suhteessa täyspäivätyöhön.

1 INTRODUCTION

Like many other countries, Finland has recently reformed its social security systems with the aim of increasing the employment rates of individuals in their 50s and 60s. Many smaller reforms of the 1990s and early 2000s culminated in a bigger reform in 2005, which eliminated certain early retirement schemes altogether and limited the access to some others.

However, the employment rate is still relatively low for older individuals, and population aging guarantees that there is still pressure for policy reforms that aim at increasing it. Broadly speaking, three different types of policy measures have been discussed. The first type of policies concern early retirement schemes. The Finnish social security system still contains schemes that clearly encourage early labour market withdrawal and also subsidize part-time work over full-time work at older ages. An obvious reform option is to eliminate or restrict these schemes.

The second type of policy measures are about increasing the eligibility age for old age pensions. Currently, old age pension benefits can be withdrawn starting from the age of 62.

The third type of policy measures are related to income taxation. For instance, it has been proposed that the government should encourage pensioners to work with a special tax exemption.

The first two of these reform types face strong opposition. Often the arguments against the reforms are based on distributional concerns. Especially early retirement schemes are seen as an important safety net for those with low earnings possibilities at old age.

In this paper, we build a dynamic programming model of individual labour supply and retirement decisions to analyse the effects of these different types of policy reforms. In addition to aggregate labour supply effects, we consider also the distributional effects of the reforms.

We build on the literature initiated by Blau (1994), Gustman and Steinmier (1986), Rust (1987), Rust and Phelan (1997) and others, that uses dynamic programming models to analyse retirement incentives. Of the more recent literature, our analysis is somewhat similar to for instance Heyma (2004).

Our model features a detailed description of the benefit rules of the Finnish pension system and unemployment insurance together with progressive income taxation. The model accounts for many of the different possibilities that

individuals have with respect to their labour supply and retirement decisions at older ages. We can also calibrate the model so that it roughly replicates the age-employment profile and the shares of individuals choosing different retirement options. For these reasons, we believe that it is a useful tool for analysing the aforementioned potential policy reforms.

The structure of this paper is the following: After this introduction, we first describe the various elements of the Finnish social security system that are in the model. In the third section, we describe the model itself and compare individuals' behaviour in the calibrated model to the empirical data. In the fourth section, we use the model to analyse different policy reforms. The last section concludes.

2 THE SOCIAL SECURITY SYSTEM

In this section, we describe the benefit rules of the Finnish social security system that are incorporated in the model.[2] The euro values of the various transfers correspond to the 2007 legislation.

2.1 The employment pension system

The Finnish employment pension system is a mandatory earnings-related pension system that covers virtually all earnings, also the very high salaries. We consider the rules that apply in the private sector since the reform in 2005.[3]

Benefits accrue by 1.5% per year of the yearly earnings until the age of 53 and by 1.9% from the age 53 to 62. During the retirement window of 63 to 68, there is a significantly higher accrual rate, 4.5% per year, for those who postpone their benefit withdrawal. For individuals of age 63–68 who work and take old age pension benefits[4] at the same time, the accrual rate is lower, namely 1.5% a year.[5]

Full old-age pension benefits can be claimed from the age of 63. They can also be taken out early, at the age of 62. However, in that case, benefits are lowered by 7.2%.[6]

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2 The model does not comprise whole of the Finnish social security system: for example, we don't consider social assistance, maternity and sickness benefits, student and other study benefits, general housing benefits, workman's compensation, rehabilitation and so forth. As we focus on the social security features in the old age, approximating work absences by the unemployment benefit system seems a feasible idea. Of pensions we leave out both private pensions and employer voluntary compensations. So far these systems have played significantly smaller role in comparison to the mandatory pension system. Of private sector employers 20 per cent have additional employer pension insurance, but 30 per cent of these insure only one employee. (Ahonen, 2006). Private pension insurance has been getting more common, but average savings are still very small.

3 See Börsch-Supan (2005) for an overview of the 2005 pension reform.

4 These rules don't apply when the person takes part-time pension – the rules of which are described below.

5 If the individual continues to work past 63 and withdraws benefits at the same time, the benefit is re-calculated and the additional pension right that was earned while receiving benefits is added to the earlier benefit at the age of 68. For technical reasons, we cannot model this exactly (we would need to keep track, as a state variable, the pensions that are earned after age 63). Instead, we assume a slightly lower accrual rate to capture the fact that postponing the payment of these "additional" benefits lowers their net present value.

6 In addition to this, the 2005 reform introduced a life expectancy coefficient that maintains the present value of benefits constant even when the life expectancy is rising. Yearly pension benefits will be cut by a share that corresponds to the expected increase in years when the benefits are received. Since this coefficient is approximately actuarially fair, we do not model it.

Earnings-related unemployment benefits also increase pension benefits. The size of the accrual is 1.5% multiplied by 0.75 times the wage that is used as a basis for the unemployment benefit.

Individuals of age 58–67 are eligible for the part-time pension. This benefit is based on "the income loss" which is the drop in wage income due to working part-time rather than full-time. The part-time pension is 50% of the income loss. During the part-time retirement, old-age pension benefits accrue at the rate of 1.9% or 4.5% (after the age of 63) of the salary despite the transition to the part-time work. In addition, old age pension benefits accrue also based on the income loss at a rate of 0.75%.

To clarify the benefit rules of part-time retirement, let us consider an individual that switches from full-time work with a salary of 100 to part-time retirement with a salary of 50. His income loss is 50. The part-time retirement benefit is half of the income loss, that is, 25. Hence his income (before taxes) will be 75. If the individual is younger than 63, his old pension benefits accrue by 1.9%*50+0.75%50. This is equivalent to an accrual rate of 2.65% of his wage income.

We do not model disability pension benefit rules in detail. We approximate the disability pension benefit by assuming that individuals in disability pension receive earnings-related unemployment benefits until 62 and old-age pension benefits after that.

2.2 National pension and the housing subsidy

The role of the national pension is to guarantee a minimum income in cases where the earnings-related pension is absent or insufficient. The national old age pension benefits are means tested against the earnings-related pension benefits. Currently (in 2008), the maximum national pension is 558 euros per month. An additional euro in earnings-related pension reduces the national pension by 50 cents. Hence, individuals with a pension higher than about 1 100 euros receive no national pension.[7]

Pensioners with low income are also entitled to a housing subsidy. The subsidy depends on household income, housing expenditure and community specific housing expenditure norms. We approximate the housing subsidy by modeling it as an additional pension that is at most 200 euros per month and subject to the same means-test as the national pension.

[7] National pensions are administered by Social Insurance Instituted which gets financing both from the social security contributions and from the national budget directly.

2.3 Unemployment insurance

Unemployed individuals receive earnings related unemployment benefits for a maximum period of two years. The replacement rate decreases with the wage level. For a monthly salary of 1 500 euros, for instance, the replacement rate is 64%. For a salary of 3 000 euros, the replacement rate is 55%.

After two years of unemployment, individuals normally receive a flat rate benefit which is about 6 300 euros a year. Yet from the age of 59 until 65, unemployed individuals have a right for extended earnings-related unemployment benefits. Hence, individuals can receive earnings related unemployment benefits from the age of 57 until retirement. This is the so-called unemployment tunnel. In the tunnel, old-age pension benefits continue to accrue. Moreover, individuals in the tunnel may withdraw their old-age pension benefits without any reduction at the age of 62 (instead of the usual age of 63). Or they can choose to continue on unemployment benefits (thereby increasing their future old age pension benefits) until the age of 65. In the model, they choose the option that maximizes their remaining lifetime utility.

The eligibility age for the extended earnings related benefits has last been increased in 2005 when it was increased from 57 to the current 59. Kyyrä and Wilke (2007) have studied the previous reform in 1997 where the eligibility age for extended earnings related benefits was increased from 55 to 57. They found that the reform decreased unemployment substantially and rapidly in the age group concerned.

2.4 Taxation and social security contributions

We also account for the progressive income taxation. The model contains the actual income tax rules which consist of a flat rate municipal tax rate[8], a progressive state tax schedule together with various exemptions that depend on the source of income (wage income, unemployment transfers, or pension benefits) and the level of income.

Wages and all mandatory pension benefits are taxed with the same tax schedule, but they are subject to different exemptions. Of special interest to us is the case where the taxpayer receives both wage income and pension benefits. Table 1 shows the tax rates for different combinations of wage and pension income. It also shows the effective average tax rates that apply to wage income alone. These rates are shown in parenthesis. For instance, the income tax rate

[8] Even if de jure municipal taxation is proportional (with different rates for different communities), de facto it is progressive because of the tax exemptions. These exemptions are taken into account in the model.

for someone who receives 10 000 euros a year in wage income and 20 000 in pension income is 25%. And if a person with a pension income of 20 000 euros who initially does not work decides to work and earn a wage income of 20 000 euros, his tax bill will increase by an amount that is 42% of his wage income.

Table 1 Average tax rates for different combinations of wage and pension income and average tax rates for wage income alone (in parenthesis).

Wage income	Pension income			
	0	10 000	20 000	30 000
0	-	6%	20%	28%
10 000	14% (14%)	18% (31%)	25% (35%)	30% (38%)
30 000	27% (27%)	30% (39%)	33% (42%)	35% (42%)
50 000	34% (34%)	36% (42%)	37% (44%)	39% (46%)

Pensions contributions are proportional. They are mandatory and divided into contributions by the employer and employee. Here we account for the contributions that are paid by the employee only. Employee contributions for those over 53 years are higher than those in the age range of 18 to 52. Contributions are paid until the age 68 if working and also when work is done while withdrawing pension benefits. We also account for other mandatory social security contributions paid by the employee, namely unemployment and sickness insurance contributions.

3 THE MODEL

In this section, we describe our model. Because of the complexity of the various tax and transfer systems involved, we do not describe the model in full detail, but just try to explain its structure and main elements.

3.1 Overview

We model individuals' participation and retirement decisions starting from the age of 20 until the age of 68. The model period corresponds to one year. Unless the individual has been hit by the disability shock, she decides each period whether to work full-time or part-time or not to work at all. Those who decide to work receive wage income. Those who decide not to work receive unemployment benefits. Individuals who are age-eligible may also decide to draw pension benefits. In addition, individuals may draw pension benefits and wage income at the same time.[9]

The individual problem is stochastic because of wage uncertainty and disability shocks. In the beginning of each period, the individual learns the wage she would receive if she decides to work. When making her labour supply decision, she compares her net wage to an alternative compensation – to the unemployment benefit, and, if she is age-eligible, also to the pension benefits. She also takes account of the intertemporal linkages between her current decisions and future benefits. One such a link is the effect of today's labour supply decision today on future pension benefits. Another important link is the dependence of the unemployment benefits on the length of the unemployment spell (that is, previous labour supply decisions).

We do not model individual savings or borrowing. Hence, consumption is constrained to equal net income each period. This is of course a simplification. We are forced to do it in order to capture the rules of the pension system in detail. However, the role of private pension savings is very limited in Finland. In the 2004 wealth survey of Statistics Finland, of households of age 60–70, less than 10% had private pension insurance. Moreover, while the median net wealth of these households was 182 000 euros, most of it was in the form of owner housing, which cannot be easily used to smooth consumption over time. The median financial gross wealth (excluding loans) was just 13 700 euros – much less than the median of the annual pension income which was 16 300 euros.

[9] This is a relevant alternative. In the end of 2006, half of those who work after age 63 draw pension benefits at the same time. The 2005 reform probably made this option more lucrative for many individuals.

3.2 Wage process

The wage process is the following:

$$\log(w_j)=\rho \log(w_{j-1})+a_0+a_1 j+a_2 j^2+ a_3 j^3+ a_4 j^4+\varepsilon$$

where w_j is the annual wage level at age j and ε has a normal distribution with mean zero and variance δ_ε^2.

The parameters for the wage process were estimated from an individual-panel data on earnings from 1962 to 1999.[10] These panel data were collected for pension policy planning, and they contain a sample of individuals with all of their employment dates and yearly earnings. The coefficients of the regression were estimated as if the data were a cross-section with a full set of yearly dummies. All zero wages were excluded, but other small values maintained. The estimated value for ρ is about 0.90.

On top of the estimated wage process, we also scale down the wage offers after unemployment, as unemployment spells are expected to reduce wages (Kyyrä, 1999). Each year in the unemployment reduces future wage offers by 10%. This feature is helpful in making the labour supply behaviour realistic. In the absence of it, some individuals find it optimal to switch very often between full-time work and unemployment.

We compare the resulting wage distribution, given endogenous labour supply decisions, to the empirical one in section 3.7 below.

3.3 Social security

As mentioned in section 2, we carefully model three retirement schemes. The first scheme is the old-age pension scheme, which is available from the age 60 onwards. The second scheme is the unemployment tunnel, which starts at the age of 57. The third scheme is the part-time pension, which starts at the age of 58. The allocation of individuals between these schemes is endogenous.

In addition to the old-age pension, unemployment tunnel, and part-time pensions, we also model the disability pension scheme. Entry to the disability pension scheme is, however, exogenous. Individuals have an age-dependent probability to become disabled. When an individual is hit with disability, she is forced to retire. Disability benefits depend on past wage earnings much of the

[10] We scale the wages so that average nominal wage is the same as in the 2007 data. This is important because various transfers are specified in absolute terms.

same way as the other pension benefits do.[11] The age-dependent transition probabilities to disability pension are obtained from the data.

Exogeneous disability retirement is a simplifying assumption. For sure, in the real world there is an endogenous component in disability retirement as well, so that the use of the disability pensions reflects also economic incentives. Using cross-country comparisons, Börsch-Supan (2007) argues that the rules of disability insurance indeed matter a lot. However, in order to model realistically the effects of such incentives, we would arguably need health as a state variable in the individual's model. That would considerably complicate the model. Out of the major retirement schemes, we assessed that disability retirement is less incentive-prone than old-age, part-time and unemployment retirement.

3.4 Individual's problem

In every period, the individual has a maximum of 8 options:

1) Be unemployed
2) Work part-time
3) Work full-time
4) Work part-time and draw old-age pension benefits
5) Work full-time and draw old-age pension benefits
6) Work part-time and draw part-time pensions
7) Be unemployed in the unemployment tunnel
8) Retire and draw old age pension benefits

Before age 57, only the first three options are available. Options 4), 5) and 8) are available from age 62 onwards. Option 6) is available from age 58 onwards and option 7) from age 57 to 65.

In order to capture the relationship between current labour supply decisions and future benefits, we need to keep track on the following individual *state variables*: 1) current wage level, 2) pension benefits earned from previous employment contracts, 3) last wage income from the previous job, 4) whether the individual has been unemployed zero, one, or at least two periods in a row, 5) whether the individual is in the unemployment tunnel or not (this matters because of the way that old-age pension benefits are determined following the tunnel).

[11] There are a few additional features that would need to be taken into account when modelling disability pension benefits (sickness allowance, one-time level increase at the start of the pension and accrual from the years when not working). As we keep the disability pensions exogeneous and do not look at the benefit levels, we don't need to model these features fully.

Let us denote the vector of all state variables in age *j* by x_j and the law-of-motion for the state variables by function $S(x_j, d_j, \varepsilon_{j+1})$, where d_j denotes the individual's choice (one of the 8 options above) in age *j* and ε_{j+1} the wage shock in following period. Let $V_j^w(x_j)$ denote the *value function* of an individual of age *j* in state x_j who has not been hit by the disability shock. The value function gives the expected remaining life-time utility from age *j* onwards given current state and optimal labour supply and retirement decisions in the future. Let $V_j^d(x_j)$ denote the remaining lifetime utility that follows if the individual is hit with the disability shock and θ_j denote the age dependent probability of becoming disabled. Let *u(c,l,j)* denote the periodic utility function given consumption, c, time spent working, l, and age. Finally, let β>0 denote the subjective discount factor. The individual's optimisation problem can now be written recursively in the following rather general form:

(1)

$$V_j^w(x_j) = \max_{d_j} \{u(c_j, l_j(d_j), j) + \beta(1-\theta_j)EV_{j+1}^w(x_{j+1}) + \beta\theta_j V_j^d(x_j)\}$$

$$s.t.$$

$$c_j = W_j(x_j, d_j) + B(x_j, d_j) - T(x_j, d_j)$$

$$x_{j+1} = S(x_j, d_j, \varepsilon_{j+1})$$

The first constraint sets consumption equal to net income each period. Net income equals wage income, *W(.)*, possible unemployment or pension benefits, *B(.)*, less income taxes *T(.)*. The second constraint is the law-of-motion for the state variables. The function S describes, for instance, how current wage income affects future pension benefits. It is this function, together with the benefit function *B*, that contains the key elements of the social security system.[12]

[12] The c++ code that specifies these functions is available upon request.

3.5 Preferences

We assume that periodic utility function takes the following form:

$$u(c,l,j) = c^{1-\sigma}/(1-\sigma) - f_j^{\,1} I^1 - f_j^{\,2} I^2,$$

where c is consumption, $l \in \{0, 0.5, 1\}$ is the time spent working, j is age, I^1 is an index function that equals one if $l = 0.5$ and zero otherwise, I^2 is an index function that equals one if $l = 1.0$ and zero otherwise. Finally, $f_j^{\,1} > 0, f_j^{\,2} > 0$ are the utility costs associated with working either part-time or full-time.

These preferences are age-dependent through the disutility parameters. We assume that after age 60, the disutility associated with both part-time and full-time work starts to increase at a constant rate. That is,

$$f_j^{\,i} = \mu^j \overline{f}^{\,i} \quad \text{for } i = 1,2 \text{ and } j > 60$$

$$f_j^{\,i} = \overline{f}^{\,i} \quad \text{for } i = 1,2 \text{ and } j \le 60,$$

where $\mu > 1$.

The reason we allow for age-dependent preferences is that it allows us to replicate the observed aggregate age-profile of employment with different preference parameters σ and β. That in turn allows us to do (later) sensitivity analysis with respect to preference parameters. It is possible to roughly replicate the observed retirement behaviour without age-dependent preferences but that requires a certain specific combination of the risk-aversion and discount parameters.

3.6 Calibration

We first fix some of the preference parameters based on previous related literature. Then we choose the remaining parameters so as to replicate some key aggregate statistics about employment and retirement in the data.

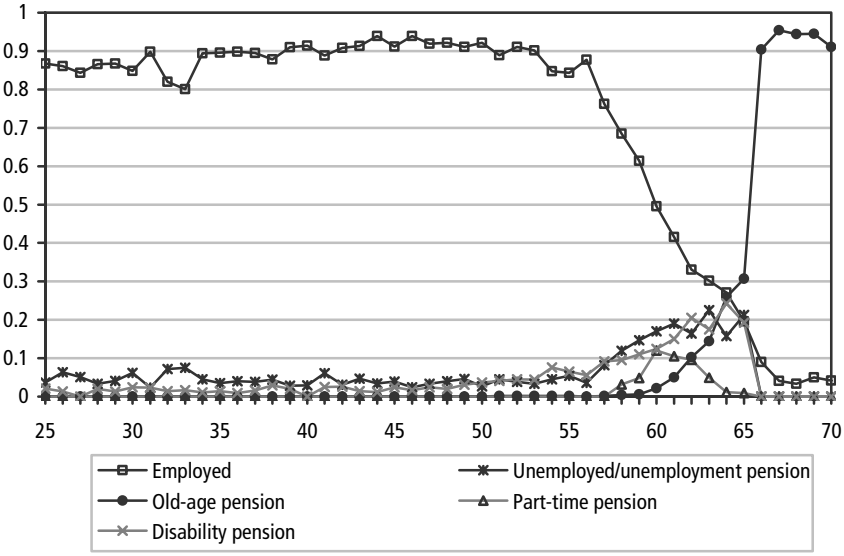
Specifically, we need to set numerical values for the preference parameters $\{\sigma, \beta, \overline{f}^{\,1}, \overline{f}^{\,2}, \mu\}$. In our benchmark calibration, we first set σ=1, which is a relatively conventional value for the risk-aversion parameter. We also set the discount factor at β=0.95, which implies a subjective annual discount rate of about 5%.

We then choose the remaining three preference parameters to roughly match the share of employed individuals that are not withdrawing any pension in the age group 25–68 and in the age group 55–68. In our 2006 data, these shares are 74% and 37%, respectively.[13] In addition we match the share of individuals that withdraw part-time pensions. In the data, 6% of the population in the age group 58–68 withdraw part-time retirement benefits. The calibrated parameter values are $f^1=0.45$, $f^2=0.65$ and $\mu=1.05$. The last of these parameters implies that the utility cost associated with full-time and part-time work increase by 5% a year after age 60.

3.7 Simulated vs. empirical data

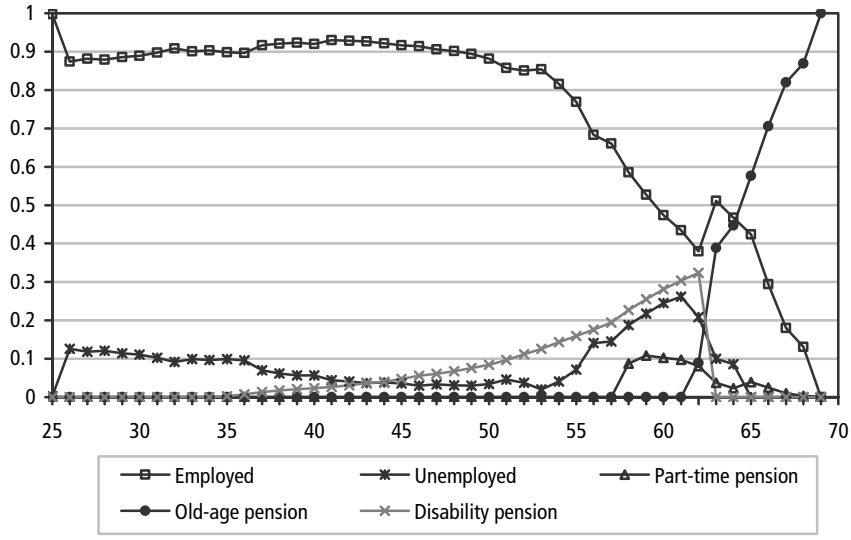
Figure 1 shows the age profiles of the share of individuals in employment (without any pension), unemployment, old age pension, part-time pension and disability pension in the data. Figure 2 shows the equivalent profiles in the model based on the simulated life cycles of 5 000 individuals with different realizations of the wage process. Unemployment pensions were phased out in the 2005 reform and replaced by an extended period of earnings-related unemployment benefits. For comparison with the model, we have therefore added individuals in the unemployment pension to unemployed. The sharp fall in unemployment at age 65, both in the empirical data and in the model, simply reflects the fact that unemployment benefits cannot be obtained after that age.

Figure 1 Labour market states in the Income Distribution Survey of 2006.



[13] The share of individuals that are working at least part-time is somewhat higher than this 37%. In addition to individuals that withdraw part-time pension benefits, some of the individuals that receive old-age benefits are working. However, our empirical data does not allow us to tell exactly how many of those receiving old-age benefits are working at the same time.

Figure 2 Labour market states in the model.

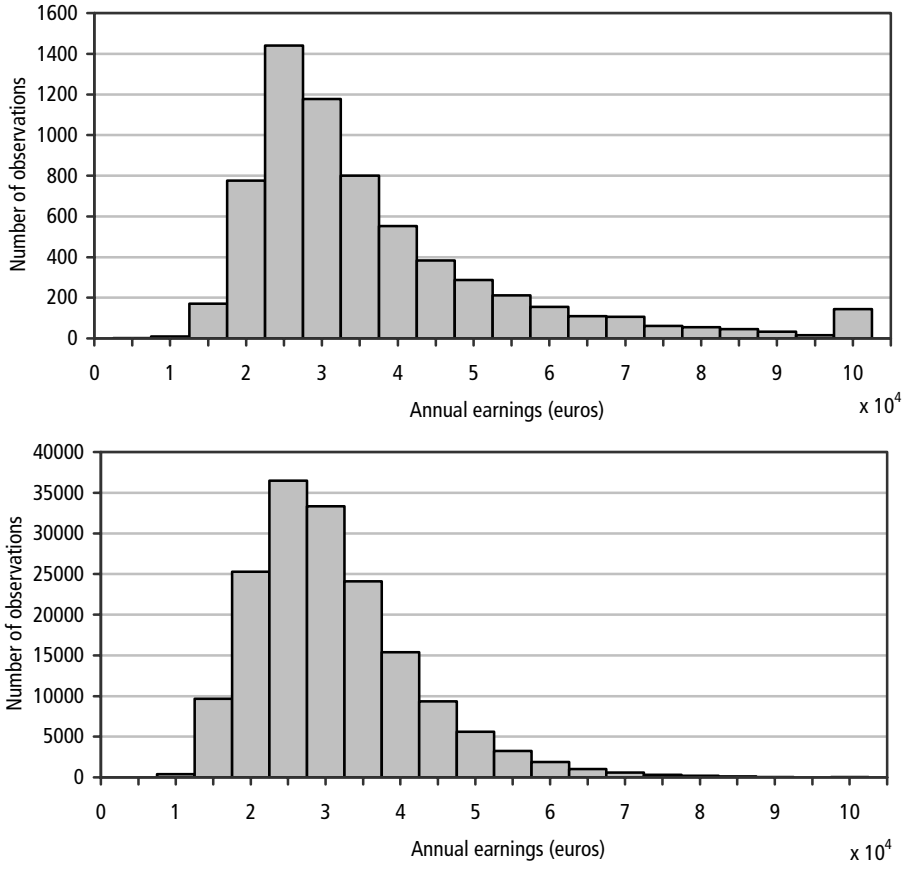


The simulated data roughly replicates the empirical profiles in figure 1. Both in the empirical data and in the model, the employment rate stays relatively constant until the age of 55 or so, and falls to about 40% at the age of 60. Also the unemployment rate displays a similar peak after the age limit of the unemployment tunnel.

The main differences between the empirical and the simulated data are easily explained by recent changes in the social security system. First, in the empirical data, some individuals are in old-age pension before the age of 62. Withdrawing old-age pension benefits before the age of 62 was possible before the 2005 reform but not after it. In the model we have the post-reform rules. Second, the drastic peak in the retirement rate at age 63 in the model, is largely explained by the fact that in the current system, disability pensions are converted into old-age pensions at that age. In the old system, they were converted into old-age pensions at age 65. Finally, the retirement rate after age 63 in the simulated data is than in the empirical data. This may reflect higher accrual rates that were introduced in the 2005 reform for those who continue to work without withdrawing old age pension benefits. It is clear that the data cannot yet fully reflect this incentive change.

In figure 3, we compare the wage earnings distribution in the empirical data to that in the simulated data (we have truncated both distributions at 100 000 euros). The simulated distribution consists of all those individuals that work at least part-time. The empirical distribution consists of those that have had a job for every month in 2006. The empirical distribution is somewhat wider than the simulated one.

Figure 3 Earnings distribution in the empirical (above) and simulated data (below).



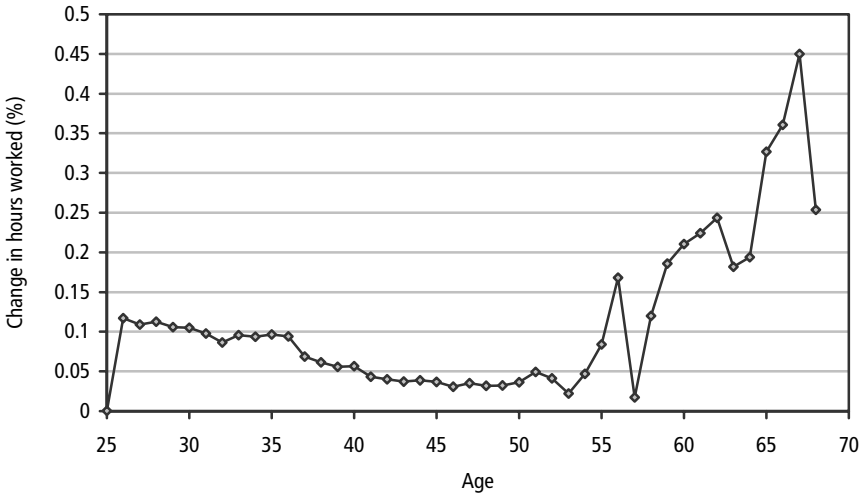
3.8 Aggregate labour supply elasticity

In the model economy, the aggregate labour supply stems from individuals' decisions to work full-time, part-time or not all. At the individual level, the labour supply decision depends on the relevant state variables. Hence, the aggregate labour supply and its wage elasticity is determined by the whole distribution of individuals over their state variables. Figure 4 illustrates how the aggregate labour supply elasticity depends on age. It shows the change in labour supply (hours worked) by age that follows from a 10% increase in net wages. (Notice that a 10% increase in gross wages would induce a much smaller change in labour supply, since a large part of the wage increase would be taxed away.)

The figure shows that aggregate labour supply elasticity is very different in different age groups. The elasticity is the lowest for middle-aged individuals and

the highest for individuals above the entitlement age for old-age benefits. Intuitively, since older individuals have different retirement options available, many of them are close to being indifferent between working or not. This means that a small change in the incentives to work induces many individuals to change their labour supply decision. The figure also reflects the importance of the various age limits of the social security system. They induce large changes in the elasticity from one year to the next.

Figure 4 Changes in hours worked following a 10% increase in net wages.



4 RESULTS

We now use the model to evaluate different policy reforms that aim at postponing labour market withdrawal. Our results are based on simulations of 5 000 individuals in the model economy with pre-reform and post-reform benefit rules. We use the same set of wage and disability shock realizations before and after the reform.

For each reform, we first show the aggregate labour supply effects in the age group 55–68 (effects at younger ages are very small). In the following tables (see e.g. table 2), "Part- or full-time work" refers to the share of individuals working either full- or part-time, including those who receive some pension benefit at the same time. "Hours worked/potential" is a measure of total labour supply: it would be 100% if all individuals in this age group worked full-time and 50% if all individuals worked part-time. "Unemployed" refers to the share of individuals that do not work and withdraw unemployment benefits and "Retired with old-age pension" to the share of individuals that do not work and receive old-age pension benefits.

We also consider a measure of the fiscal effect of these reforms. The fiscal effect is computed by adding up different taxes paid as well as the various transfers received by the individuals, subtracting transfers from taxes, and dividing the outcome by the number of observations in the simulated data. The transfers consist of unemployment and pension benefits. In addition to the income taxes and social security payments which are in the model, we take into account consumption taxes which are assumed to be 27% of the disposable income. This number is based on Eurostat (2008) and it takes into account various commodity taxes in addition to VAT. We report the per capita difference between taxes and transfers. This is in many ways an inaccurate estimate of the true fiscal effect of these reforms.[14] Nevertheless, we think that this measure allows for an interesting and meaningful comparison of the fiscal effects of the different reforms considered.

Finally, we also compare individual behaviour by reporting the number of years that individuals of age 55–68 spend in different labour market states and the transitions that occur from one state to another following a reform (see e.g. table 3). As we simulate the life cycles of 5 000 individuals, we have 70 000 individual and age specific years in this age group. Since the set of underlying realizations of the wage and disability shocks are identical, it makes sense to compare the simulated data before and after a reform at an individual level.

[14] In particular, this is just the steady state change in taxes and transfers.

Specifically, we show the number of years spent in the following labour market states: i) unemployed, ii) full-time work without withdrawing pension benefits, iii) full-time work with old-age pension benefits, iv) part-time work with part-time pension benefits, and v) retired. The first group includes all those that receive unemployment benefits. The last group consists of those that do not work at all and receive either old-age pension benefits or disability pension benefits. There are two other possibilities, namely part-time work with or without old-age pension benefits. However, in the present calibration no one chooses to work part-time without part-time pensions under any of the social security systems considered.[15] Hence, we can leave these two states out of these tables.

4.1 Eliminating early retirement schemes

Labour supply and fiscal effects

Table 2 shows that with the current rules, the share of individuals working part- or full-time in the age group 55–68 is 47% in the model economy.[16] Removing the unemployment tunnel increases that share to 54%, while removing (only) part-time pensions decreases it to 45% and eliminating both systems increases it from 47% to 52%.

The reason why eliminating part-time pensions decreases the share of individuals that are working is simple: part-time pensions subsidize part-time work over both full-time work and unemployment. In the absence of part-time pensions, some individuals choose to be unemployed instead of working part-time.

However, hours worked increase also following the elimination of the part-time pension system. Hence, according to the model, the part-time pension system decreases aggregate labour supply. If we remove both the unemployment tunnel and part-time pensions, hours worked increases by 8 percentage points or 18% in the age group 55–68.

The fiscal effect is always positive. It is also relatively big: the per capita "surplus" increases by 5% when both early retirement systems are removed.

[15] Intuitively, this happens because the part-time pension system is very lucrative. In order to match the actual share of workers in part-time pension, we have to choose a relatively high value for the parameter that determines the disutility of part-time work. As a result, working part-time without part-time pensions is not a relevant option.

[16] In the calibration we targeted, because of data restrictions, the share of individuals that work without withdrawing pension benefits. That share is 37% in this age group. The share we report here includes those that work and withdraw old-age benefits.

Obviously, the overall fiscal effect stems from both an increase in the tax revenue and a decrease in transfers.

Table 2 Labour supply (age 55–68) and fiscal effects of removing the unemployment tunnel and/or part-time pensions.

	Current system	Tunnel Removed	Part-time pensions removed	Both the tunnel and part-time pensions removed
Part- or full-time work	47%	54%	45%	52%
Hours worked/potential	44%	50%	45%	52%
Unemployed	12%	4.8%	13%	5.8%
Retired with old-age pension	28%	28%	28%	28%
Taxes less transfers	12 705€	13 111€	12 843€	13 368€

Tables 4 and 5 compare individual behaviour following the elimination of the unemployment tunnel and part-time pensions, respectively. In both tables, most of the observations are in the diagonal. This just means that at any age, most individuals would make the same choices irrespective of these reforms. For instance, table 3 tells us that 27 046 age and individual specific years are spent working full-time without pension benefits both in the current system and after the tunnel is removed.

Following the elimination of the unemployment tunnel, most of the transitions are from unemployment to part-time and full-time employment: of all the years that are spent unemployed before the reform, 1951 are spent working full-time without pension benefits, 280 are spent working full-time with pension benefits, and 2 739 are spent in part-time pension after the reform.

Somewhat surprisingly, 97 (=86+11) full-time employment years change into part-time pension years. One possible explanation for this is that the possibility of going to the unemployment tunnel itself induces some individuals to work full-time at some point because that ensures them higher unemployment benefits in the tunnel. This effect is not important in aggregate terms, but it illustrates how complex the overall incentive structure is.

Table 4 shows that most of the years that spent in part-time pension (1 860 out of 3 082) in the current system, are spent working full-time without withdrawing old-age pension benefits after the reform. However, 898 part-time pension years become unemployment years and a few full-time employment years become unemployment years. The reason could be that in the current system, some individuals work full-time partly because that gives them higher part-time pension benefits in the future. Hence, for them, removing part-time pensions may make unemployment more attractive compared to working full-time.

Table 3 Transitions (age 55–68), unemployment tunnel removed.

Before the reform	After the reform					
	Unemployed	Full-time, no pension	Full-time, old-age pension	Part-time pension	Retired	Total
Unemployed	3 058	1 951	280	2 739	295	8 323
Full-time, no pension	0	27 046	43	86	22	27 197
Full-time, old-age pension	7	30	2 212	11	67	2 327
Part-time pension	0	474	60	2 492	56	3 082
Retired	297	169	46	17	28 542	29 071
Total	3 362	29 670	2 641	5 345	28 982	70 000

Table 4 Transitions (age 55–68), part-time pension removed.

Before the reform	After the reform					
	Unemployed	Full-time, no pension	Full-time, old-age pension	Part-time pension	Retired	Total
Unemployed	8 064	54	97	0	108	8 323
Full-time, no pension	13	27 136	32	0	16	27 197
Full-time, old-age pension	0	1	2 303	0	23	2 327
Part-time pension	898	1 860	151	0	173	3 082
Retired	0	9	4	0	29 058	29 071
Total	8 795	29 060	2 587	0	29 378	70 000

Distributional effects

In the context of reforms that restrict early retirement, we also discuss distributional issues. This is because early retirement schemes are often seen as providing a "safety net".

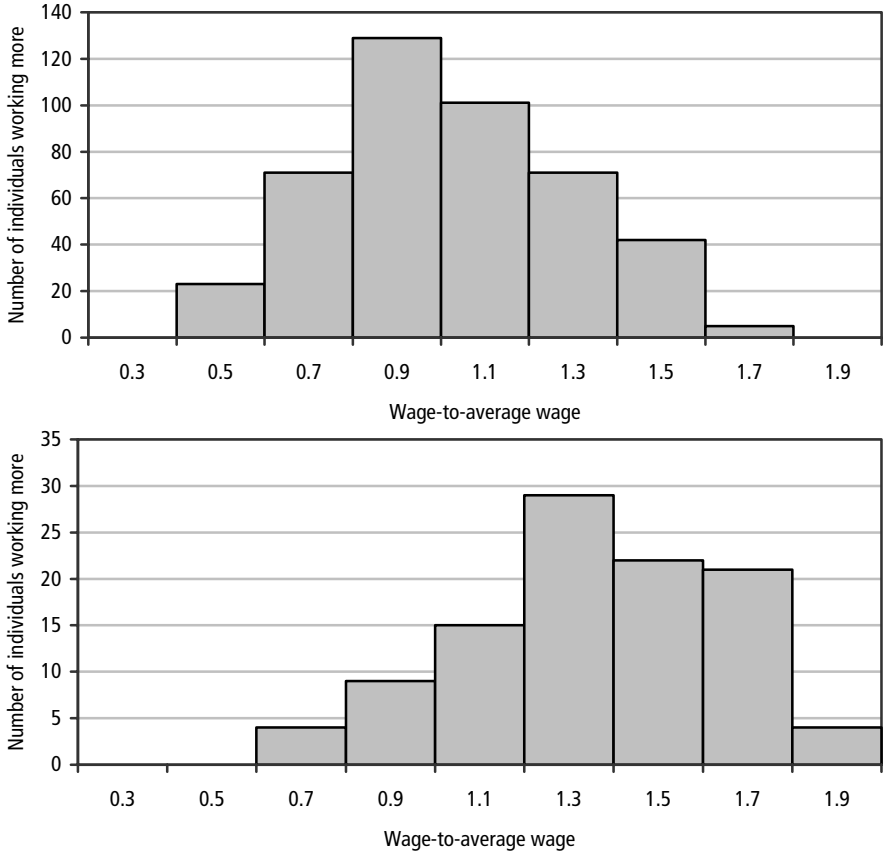
It is not obvious how the distributional effects of removing the unemployment tunnel and part-time pensions should be assessed. One possibility is to compare the distributions of net income before and after reforms. We find that removing the unemployment tunnel increases the median income of the poorest 10% of the individuals by almost 10%, while removing the part-time pension system keeps the median income of the poorest individuals almost the same.

Of course, the increase in the net income reflects increased labour supply. In terms of welfare, the picture may be very different. We also looked at the distribution of realized lifetime utilities (the discounted sum of periodic utilities). It is hard to see any systematic changes in that distribution following either of the two reforms. This suggests that the early retirement schemes are not important in terms of lifetime welfare.

To some extent at least, the early retirement systems are justified by arguing that they provide a safety net for those with low earnings possibilities at old ages. Hence, it is perhaps more informative to see whether those who work more following the elimination of the tunnel are relatively poor or relatively rich.

To this end, figure 5 compares the average wage offers at ages 55–68 of those who work more after the elimination of the tunnel or the part-time pension to the average wage offer of all individuals. For instance, a ratio of 0.5 in the figure means that the average wage offer at ages 55–68 of an individual who works more is half the average wage offer of all individuals of age 55–68.

Figure 5 Relative wages of individuals that work more after the elimination of the unemployment tunnel (above) or part-time pensions (below).



The upper part of figure 5 tells us that some individuals that are induced to work more by the elimination of the tunnel are remarkably poor in terms of their earnings possibilities. It also seems that a majority of them have below-average earnings possibilities. In this sense, the unemployment tunnel seems to work as an insurance system (albeit arguably a relatively inefficient one) against low earnings possibilities at old age. The lower part of the figure shows that eliminating part-time pensions, in contrast, induces mainly individuals with relatively high wages to work more. In this sense, the part-time pension system does not work as an insurance system against low earnings possibilities.

These distributional effects are perhaps not very surprising. After all, the rules of the tunnel or part-time pensions do not include elements that would suggest that they are designed so as to attract mainly poor individuals. The only progressive element is that earnings related unemployment benefits are a progressive function of previous wages.

4.2 Increasing the entitlement age for old-age pension benefits

We now consider increasing the entitlement age for old-age pension benefits. Specifically, we increase the entitlement age to old-age pension benefits from 62 to 65. We assume that at age 65, individuals can withdraw benefits without an early withdrawal reduction. We do not restrict the early retirement schemes, but remove the possibility to withdraw old age pension benefits earlier than the full eligibility age for the old age pension benefits (recall that in the current system individuals can start withdrawing old-age pension benefits at the age of 62 – a year earlier than the full retirement age – if they accept a 7.2% reduction in benefits).[17]

The aggregate results can be seen by comparing the first and the second column in table 5. Strikingly, increasing the entitlement age in the old-age pension system reduces aggregate labour supply. The fiscal effect is also negative.

The main reason why labour supply decreases following this reform, is the increase in the use of the unemployment tunnel. As table 6 shows, 627 full-time working years without pension become unemployment years. Also, many retirement years (986) become unemployment years. Intuitively, removing the option of working while withdrawing old-age pension benefits (for ages 62–64),

[17] However, the reform indirectly affects also the unemployment tunnel, because individuals in the tunnel can no longer receive old-age benefits before age 65 – they can only choose to take unemployment benefits.

decreases labour supply because the next best option for many is not to work at all.[18]

The reform also increases the use of the part-time pension system. Presumably, many individuals who in the current system find it optimal to work full-time until 63 or 64 and then retire, choose to work part-time until age 65 or so in the new system.

Table 5 Labour supply (age 55–68) and fiscal effect of an increase in the entitlement age.

	Current system	Retirement age increased to 65
Part- or full-time work	47%	45%
Hours worked/potential	44%	42%
Unemployment rate	12%	14%
Retired with old-age pension	28%	26%
Taxes less transfers	12 705€	12 220€

Table 6 Transitions (age 55–68), entitlement age increased.

Before the reform	**After the reform**					
	Unemployed	Full-time, no pension	Full-time, old-age pension	Part-time pension	Retired	Total
Unemployed	8 208	39	0	76	0	8 323
Full-time, no pension	159	25 234	168	1 569	67	27 197
Full-time, old-age pension	627	685	639	165	211	2 327
Part-time pension	109	5	1	2 956	11	3 082
Retired	986	128	40	54	27 863	29 071
Total	10 089	26 091	848	4 820	28 152	70 000

4.3 Tax reforms

As mentioned in the introduction, it has been discussed whether the income tax system should be changed so as to encourage old age labour supply. One argument is that because of the tax progression, a given wage income is taxed at a higher rate if a person also receives pension benefits. Another argument is that labour supply elasticity is higher among older individuals than younger ones.

[18] For sure, there is another effect as well. By lowering the present value of benefits, raising the entitlement age lowers the return for pension contributions. This makes individuals work less.

There are many ways by which the effective tax rate on older individuals or for pensioners could be lowered. In order to illustrate the importance of the income taxation, we consider two stylized reforms. In the first one, we lower the yearly income tax bill of individuals who are 63 or older and have wage income by 10% (independently of whether they have also pension income or not). In the second stylized reform, we restrict the tax cut to individuals who receive both wage and pension income (and are at least 63 years old).

Table 7 shows the aggregate labour supply effects and the fiscal effect of the two reforms. The first reform increases hours worked in the age group 55–68 by about 5% whereas the second reform decreases it by about 2%. The fiscal effect of the first reform is positive: that is, even though income taxes are lowered, the overall tax revenue increases slightly (in part due to increased consumption tax revenue). Given the labour supply effects, it is obvious that the fiscal effect of the second reform is negative.

Hence, it seems that if we are to encourage old age labour supply with special tax incentives, it is better to target them to all workers, not just to pensioners (as has been proposed). Tables 8 and 9 are helpful in understanding this result. Following the second tax reform, many years (1910) that in the current system are spent working full-time without pension benefits, become part-time pension years. This is natural, since it is only the option of working and withdrawing pension benefits that is made more lucrative. Following the first reform, part-time pension years increase much less.

Somewhat surprisingly, a number of years that are spent working full-time while withdrawing pension benefits in the current system are spent unemployed or even working full-time without pension benefits after the second reform. A closer inspection of the simulated data (not shown) reveals that most of these transitions occur before age 63. Hence, this reform induces some individuals to work more after age 63 and less before it.

Table 7 Labour supply (age 55–68) and fiscal effects of tax reforms.

	Current system	1. tax reform	2. tax reform
Part- or full-time work	47%	48%	47%
Hours worked/potential	44%	46%	43%
Unemployed	12%	12%	14%
Retired with old-age pension	28%	26%	25%
Taxes less transfers	12 705€	127 52€	12 245€

Table 8 Transitions (age 55–68), 1. tax reform.

Labour market states before the reform	Labour market states after the reform					
	Unemployed	Full-time, no pension	Full-time, old-age pension	Part-time pension	Retired	Total
Unemployed	8 141	23	20	130	9	8 323
Full-time, no pension	0	26 802	355	38	2	27 197
Full-time, old-age pension	2	9	2 313	3	0	2 327
Part-time pension	2	26	26	3 027	1	3 082
Retired	44	110	909	50	27 958	29 071
Total	8 189	26 970	3 623	3 248	27 970	70 000

Table 9 Transitions (age 55–68), 2. tax reform.

Labour market states before the reform	Labour market states after the reform					
	Unemployed	Full-time, no pension	Full-time, old-age pension	Part-time pension	Retired	Total
Unemployed	8 125	39	0	159	0	8 323
Full-time, no pension	151	24394	709	1 910	33	27 197
Full-time, old-age pension	574	610	798	308	37	2 327
Part-time pension	94	9	16	2 956	7	3 082
Retired	981	138	555	156	27 241	29 071
Total	9 925	25 910	2 078	5 489	27 318	70 000

4.4 An alternative way of eliminating the unemployment tunnel

The previous results suggest that the most straightforward and cost-effective way of increasing labour supply at old ages is to simply eliminate the unemployment tunnel. However, it is clear that such a reform would have adverse distributional effects. Therefore, we consider here a somewhat more moderate way of eliminating the tunnel.

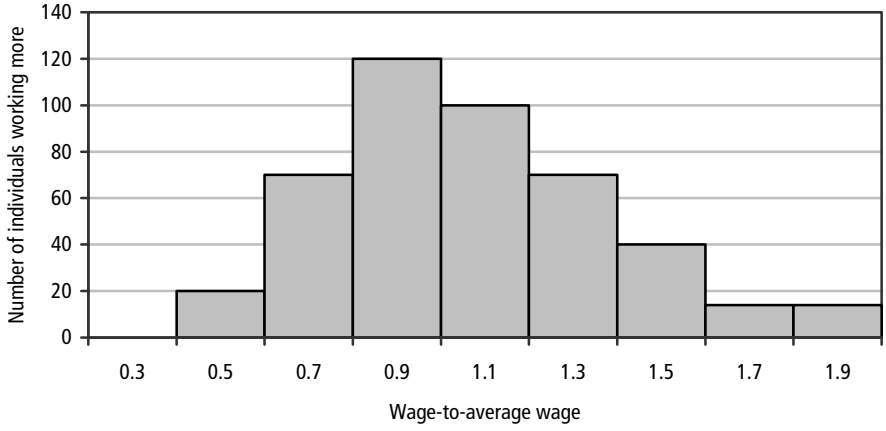
Specifically, we consider a reform that compensates the elimination of the right for extended earnings related unemployment benefits with a transfer to those who work full-time after two years of unemployment. The transfer equals the flat rate unemployment benefit. The idea is to lower the effective tax rate on work without weakening the insurance against low earnings possibilities at old age too much.

We limit the right to receive the new transfer the same way as we limit the right for extended earnings-related unemployment benefits in the unemployment tunnel. That is, the individual must be older than 57 and she must have been unemployed for two years in a row. Without such a limitation, all individuals that work without withdrawing a pension benefit after the age limit would receive the transfer.

This alternative reform increases the employment rate in the age group 55–68 from 47% to 52% and our measure of hours work from 44% to 49%. As shown in table 2, simply eliminating the unemployment tunnel increases the employment rate to 54% and hours worked to 50%. Hence, in terms of hours worked we get almost the same effect with this alternative reform. The fiscal effect, however, is more modest. Our "taxes less transfers" measure increases from 12 705€ to 12 768€ whereas simply eliminating the tunnel increases the fiscal measure to 13 111€. The reason why the fiscal effect is smaller is of course related to the cost of providing the new transfer to some older workers.

Figure 6 shows earnings possibilities of those individuals that the reform induces to work more after age 55. Like the reform that just eliminates the unemployment tunnel, this reform induces many low income individuals to work more. However, compared to just eliminating the unemployment tunnel, these low wage individuals fare better after this reform because the flat rate unemployment benefit supplements their wage income. Comparing figure 6 to the upper part of figure 5 also reveals that compared to the reform that only eliminates the tunnel, this reform induces more individuals with high wages to work more.

Figure 6 Relative wages of individuals that work more after the alternative elimination of the unemployment tunnel.



4.5 Robustness

In this section, we briefly consider the robustness our results with respect to the calibration. Specifically, we experiment with different assumption about the parameter σ. This parameter determines both the intertemporal elasticity of substitution and risk-aversion. For each σ we recalibrate the endogenously determined preferences parameters $\{\overline{f}^1, \overline{f}^2, \mu\}$ so as to roughly match the same targets as in the benchmark calibration.[19] We then look at the aggregate labour supply effects of a reform that eliminates both the unemployment tunnel and the part-time retirement system. The results are shown in table 10.

The aggregate labour supply effects of this reform are very similar in all three calibrations. This suggests that our main results are not robust with respect to this preference parameter. However, the share of individuals that work and the share of individuals that are retired with old age benefits are quite different in different calibrations (recall that in the calibration we target the share of individuals that work without withdrawing old-age benefits). Hence, the assumption about the risk-aversion parameter seems to matter for the decision of whether or not to withdraw pension benefits while working.[20]

Table 10 Labour supply (age 55–68) effects of removing the unemployment tunnel and/or part-time pensions in age group 55–68, and the fiscal effect. Robustness analysis.

	σ =1		σ =0.5		σ =1.5	
	Current system	After reform	Current system	After reform	Current system	After reform
Part- or full-time work	47%	52%	59%	63%	41%	48%
Hours worked/potential	44%	52%	56%	63%	39%	48%
Unemployed	12%	5.8%	7.8%	4.8%	14%	6.6%
Retired with old-age pension	28%	28%	19%	19%	31%	32%
Taxes less transfers	12 705€	13 111€	13 337€	13 860€	12 514€	13 284€

[19] The disutility parameters take very different values for different values of σ.

[20] Presumably, this is also related to the assumption that individuals cannot save or borrow.

5 CONCLUSIONS

We have analysed different reforms that aim at increasing the employment rate among older individuals using a calibrated stochastic life cycle model with endogenous labour supply and retirement decisions. The main reforms we considered were i) abolishing the so called unemployment tunnel, ii) abolishing part-time pensions, iii) increasing the entitlement age for old-age pension benefits, and iv) income tax cuts for older workers.

Our results suggest that in terms of aggregate labour supply, abolishing the unemployment tunnel would probably be the most efficient of these reforms. On the other hand, the unemployment tunnel works, to some extent at least, as an insurance system against low earnings possibilities at old age.

Eliminating the part-time pension system also increases labour supply but less than eliminating the unemployment tunnel. On the other hand, the part-time pension system attracts mostly individuals with relatively good earnings possibilities.

We found that increasing the eligibility age alone would not increase labour supply, at least not unless early retirement schemes are restricted at the same time. The main reason is that when the eligibility age is increased, the option of working and withdrawing pension benefits is eliminated for certain ages. This induces some individuals to make use of the unemployment tunnel instead of working and withdrawing pension benefits.

As for the tax reforms, we found that it may be possible to increase old-age employment with special tax incentives for older workers which are approximately revenue-neutral. This is because the aggregate wage elasticity of labour supply is very high among older individuals. However, the details of the tax reform matter a great deal. A badly designed tax cut for older workers may even reduce labour supply.

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