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LET'S MAKE A DEAL - THE IMPACT OF SOCIAL SECURITY PROVISIONS AND FIRM LIABILITIES ON EARLY RETIREMENT

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ABSTRACT: Literature on early retirement has generally ignored firms' role in the labour market withdrawals. Yet, as it is shown in this paper, employee incentives alone cannot explain the increase in unemployment at the end of the career. Instead, we construct an implicit contracts model where we account for both the firm and the worker incentives. Displacements occur only when joint utility of the two parties are greater for displacement than for continued employment. We use a firm-worker -panel to test two implications of our model. First, we find that firms target their layoffs on employees who lose least when displaced. This targeting is more frequent in firms in financial distress and during a recession. Second, we find that a change in a disability risk affects also the displacement probability. This is due to differences in experience rating for the disability and unemployment pensions.

Keywords: Early exit, implicit contracts, experience rating, unemployment of the aged

TIIVISTELMÄ: Työttömyyseläkeputkeen irtisanominen yleistyi huomattavasti laman aikana. Koska eläke- ja työttömyysturvassa ei samaan aikaan tapahtunut merkittäviä rakenteellisia muutoksia, yleistynyttä työttömyyseläkkeelle siirtymistä on vaikea perustella pelkästään työntekijän kannustimilla. Siksi tutkimuksessa sovelletaan implisiittisten sopimusten mallia eläkkeelle siirtymiseen. Mallin mukaan ikääntynyt irtisanotaan vain silloin kuin irtisanomisesta firmalle ja työntekijälle yhteenlaskettu "hyöty" ylittää työsuhteen jatkamisesta koituvan hyödyn. Testaamme kahta mallista saatavaa hypoteesia yhdistetyllä firma-työntekijä -paneelilla. Ensiksi näytämme, että irtisanomiset kohdistuvat työttömyyseläkeputkeen oikeutettuihin. Tämä valikoitu irtisanominen oli voimakkaampaa laman aikana sekä niissä yrityksissä, joilla meni huonommin. Toiseksi toteamme, että yrityksen eläkevastuilla on merkitystä. Työkyvyttömyysriskin muutos vaikutti myös työttömäksi jäämisen todennäköisyyteen. Jos työttömyyseläkkeestä koituvat yrityksen vastuut olivat huomattavasti työkyvyttömyyseläkkeestä koituvia vastuita pienemmät, kasvatti korkeampi työkyvyttömyysriski myös työttömäksi jäämisen todennäköisyyttä. Yritykset pyrkivät siten välttämään työkyvyttömyydestä koituvat kustannukset irtisanomalla työntekijän työttömyyseläkeputkeen.

Asiasanat: Varhainen eläkkeelle siirtyminen, implisiittiset sopimukset, eläkevastuut, ikääntyneiden työttömyys

Contents

1 Introduction

Extensive literature on economic incentives for retirement treats the retirement decision essentially as a labor supply issue. According to this approach, workers who approach the retirement age evaluate their prospective streams of wages and pension payments, and choose the retirement age that maximizes their expected future utility. Substantial empirical evidence shows that incentives provided by social security systems have strong impact on the labour force withdrawal of the aged (see Lumsdaine and Mitchell, 1999, for a recent survey). Actuarially unfair pensions encourage early retirement, and countries with more generous social security benefits tend to have lower average retirement age (Gruber and Wise, 1997).

Interestingly in the current literature firms are generally absent from the retirement decision. In a pure labor supply model a worker is free to choose the retirement date that is optimal for him. However, also a firm may have strong incentives to encourage early retirement of its workers. Some early retirement schemes even require an active role by firms. A typical example of this is the unemployment pension, or extended unemployment benefits for workers who lose their jobs after a certain age. For example, in the Netherlands, the unemployed who are over fifty-seven years of age, are not required to seek work in order to keep receiving their unemployment benefits (Lindeboom, 1998). In Germany, early retirement is allowed on the basis of long-term unemployment at the age of sixty. A typical lay-off pattern there is called the fifty-niner provision. Accordingly, firms lay off their employees as many months before the age of sixty as the unemployment insurance benefits last (Antolin and Scarpetta, 1998). In Finland, the unemployed who lose their jobs after the age of fifty-five are eligible for extended unemployment insurance benefits until the age of sixty. Thereafter, they may collect unemployment pension benefits until the old-age retirement at the age of sixty-five. As these unemployment benefits are relatively generous and re-employment prospects are slim, a job loss after the age of fifty-five often leads to a permanent withdrawal from the labour market.

If long-term unemployment is an important exit route out of the labour force, a comprehensive study on early retirement should focus on decisions of both the firm and the worker. In this paper, we show that neither the supply side, nor the demand side analysis alone can explain the labour market behaviour of the aged.

Instead, we follow the ideas of Feldstein (1976, 1978), Topel (1984) and Hutchens (1999), and model the retirement decision as a joint optimization problem for the worker and the firm. A risk-neutral firm maximizes profits by entering into an implicit contract with a risk-averse worker. This contract specifies wages, firing rules and possible severance payments, so that the contract maximizes the sum of the expected utilities both for the worker and for the firm. As a result of an optimal insurance model, an efficient contract guarantees a certain utility level for the worker, irrespective of the demand conditions. These demand conditions, however, influence the displacement decisions of the firm. Separations occur when the joint value of employment for the worker and the firm falls short of the outside opportunities.

Social security influences the optimal contract through unemployment benefits and unemployment pensions. The system also determines firm liabilities for these benefits. If the unemployment benefits and the unemployment pension are not fully experience-rated, social security effectively subsidizes displacement of older workers. Hence, social security can create a mechanism where early retirement may be optimal for the worker and the firm jointly, but not optimal for the society as a whole.

In this essay, we first formulate a simple optimal contract model of early retirements. We test the implications of this model using a linked worker-firm panel data from Finland over the period of 1989 - 1996. The worker data include a wealth of information on wages, employment spells and transitions between employment, unemployment and retirement. The firm data contain the balance sheet and income statement for the firms. The key feature of these data sets is the ability to link the worker and the firm records.

We find that both the worker and the firm incentives matter for early retirement. An increase of the unemployment benefits (or pensions) and a decrease of the firm liability for these benefits, encourages displacements and leads to an increase in early retirement. However, changes in productivity are the driving force in early retirement. When demand is high, social security benefits have little effect on early retirement. In a major recession, the incentives have a huge impact on the early withdrawal from the labor market.

2 Social Security for the Aged in Finland and Some Empirical Observations

Official retirement age in Finland is sixty-five. However, only a small fraction of the workers actually stay in the labor force until this age. This is mainly due to early retirement provisions. Early retirement is available for the disabled and the long-term unemployed[1]. In 1998, approximately half of the fifty-five to sixty-four year -olds received pension benefits (Central Pension Security Institute 2000).

Figure 1 shows the share of individuals in different labour market states in 1998. The employment share falls with age - specially after the age of fifty-five. After the age of sixty-five, virtually all individuals receive old-age pension. This is not only because the probability of retirement is high at this age, but also because all early retirement benefits are technically converted to old-age pensions at the age of sixty-five.

Disability pension is the most common form of early exit from the labor market as almost thirty per cent of the fifty-five to sixty-four year olds were on a disability pension in 1998 (Central Pension Security Institute 2000). Disability pensions are available for employees who suffer from deteriorated health. Disability pension benefits are roughly equal to the pension benefits that a person would be entitled to, if he retired with an old age pension. Until recently, no actuarial adjustments were made for earlier retirement. There are two types of disability pensions: normal disability pension and individual early retirement. Normal disability pension is available in all age groups. Approval for the pension benefits is subject to medical evaluation by a pension insurance physician. The second disability pension, individual early retirement, has a minimum age that was raised from fifty-five to fifty-eight in 1994[2]. Individual early retirement also requires medical examination, but the health criteria are less stringent. For example, exhaustion at work, strain of the current job, ageing in general and the length of the career can affect approval decisions.

Active labour market programme, unemployment and unemployment pension shares in figure 1 follow the institutional features of the social security

[1] In addition to the early retirement provisions due to unemployment and disability, there are some occupation-specific pension schemes where retirement can occur before the official retirement age. Until 1995, the biggest such scheme was in the public sector where the old-age retirement could occur at the age of 63.

[2] In 2000, the minimum age for the individual early retirement was further raised to sixty.

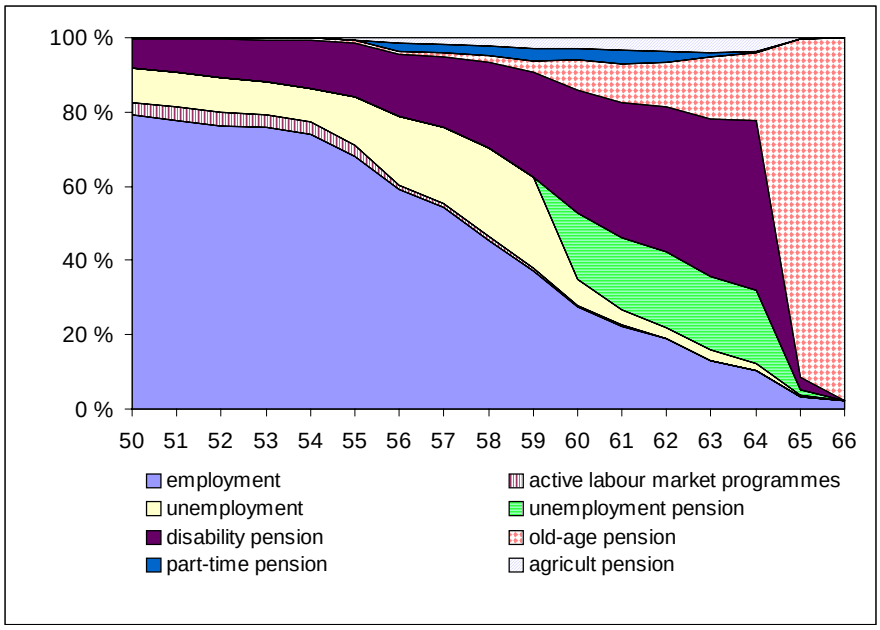

Figure 1: Labour Market Shares by Age in 1998

system[3]. The share of those in active labour market programmes phases out at the age of fifty-five since the unemployed can, from this age on, keep their earnings-related unemployment insurance benefits until the age sixty. At the age of sixty virtually all unemployed convert to unemployment pension[4].

Unemployment pension is available for the long-term unemployed after the age of sixty. The only other requirement is that the person has received unemployment benefits for the minimum of 500 days[5]. The level of the unemployment pension benefits is again almost equal to the old age pension benefits. Until 1996, no actuarial adjustments were made for early retirement. In 1998, al-

[3] Most countries do not have a separate system for the unemployment pension. In Finland, however, there is a distinction between unemployment and unemployment pension. Generally the unemployment pension benefit is higher than the unemployment benefit. Moreover, there is a greater chance that the former will be subjected to active labour market policies or cuts in the future pension benefits.

[4] The small tail of the unemployed beyond this age consists of those unemployed who have either not yet received the minimum of 500 days of the unemployement benefit or don't have a right to the unemployment pension.

[5] Before 1994, the unemployed had to receive unemployment benefits for one year in order to qualify for the unemployment pension. In 1994, this requirement was increased to two years (that is, 500 days).

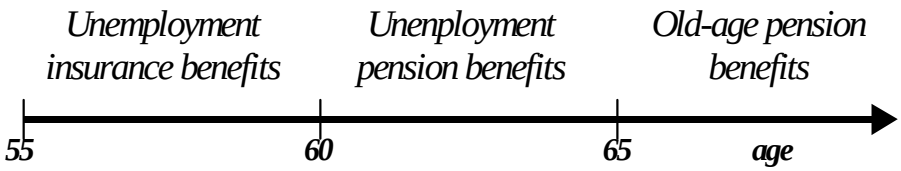

Figure 2: The Unemployment Tunnel

most twenty per cent of the sixty to sixty-four year-olds received unemployment pension (Central Pension Security Institute 2000).

Another important feature of the unemployment insurance system is the extension of the maximum duration of the unemployment benefits for those workers who lose their jobs after the age of fifty-five[6]. These workers are entitled to the unemployment benefits beyond their normal duration. Unemployment benefits last until the age of sixty when the unemployed become eligible for the unemployment pension. The combination of the extended unemployment benefits and the unemployment pension benefits is commonly called the "unemployment tunnel" (presented in figure 2).

The unemployment tunnel generates strong incentives to permanently withdraw from the labor market, up to ten years before the old-age retirement. Since it is possible that a new job, if available at all, would yield lower unemployment and pension benefits, the unemployed often have minimal incentives to search for work. Therefore, a job loss after the age of fifty-five often leads to permanent non-employment.

Table 1 shows the annual unemployment benefits and their duration for a median income worker who loses his job at or after the age of fifty. If the employee loses his job before the age of fifty-five, he may receive the earnings-related unemployment benefit for the maximum of two years. After this he is entitled to the labour market support until the old-age pension. As shown in the table, the labour market support is considerably smaller than the unemployment benefit[7]. If the employee loses his job after the age of fifty-five, he can first receive

[6] Age limit for the extension of the unemployment benefits was raised from 53 to 55 in 1997.

[7] Unemployment benefits in the table are calculated for the median income worker. With lower income, the unemployment benefit is lower, but it never falls below the labor market

age at job loss	unempl benefits		labour market support		unempl pension		average ann. benefit until age 65
	duration	amount	duration	amount	duration	amount	
50	2	86,592	13	30,960	-	-	38,378
51	2	86,592	12	30,960	-	-	38,907
52	2	86,592	11	30,960	-	-	39,519
53	2	86,592	10	30,960	-	-	40,232
54	2	86,592	9	30,960	-	-	41,075
55	5	86,592	-	-	5	63,097	74,845
56	4	86,592	-	-	5	63,097	73,539
57	3	86,592	-	-	5	63,097	71,908
58	2	86,592	-	-	5	63,097	69,810
59	2	86,592	-	-	4	63,097	70,929
60	2	86,592	-	-	3	63,097	72,495

Table 1: Unemployment Benefits and Unemployment Pensions by the Age of the Job Loss

Notes: Annual unemployment benefits are calculated for a full-time worker who earns the median annual income in 1998 (135,600 FIM), and who is covered by the unemployment insurance system. Pension calculations use the same median wage as a base wage and assume that the worker has had the same private sector job with 1.5 per cent pension accrual rate for thirty years. Moreover, he is assumed to be single and living in the more expensive community -grouping.

the earnings-related unemployment benefits until the age of sixty, and then he receives the unemployment pension until the old-age retirement. Because the combination of the unemployment insurance benefit and unemployment pension benefit is considerably greater than the combination of the unemployment insurance benefit and labour market support, there is a discrete jump in the average annual benefits if the job loss occurs after the age of fifty-five[8].

Figure 3 presents unemployment rate time series for the older age groups in Finland[9]. The figure shows how the Finnish economy experienced its largest peacetime recession in the beginning of the 1990's. Unemployment rates rose rapidly in all age groups, but the rise in the unemployment rate was much greater for the workers who were eligible for the extended unemployment ben-

support.

[8] Table 1 shows that the former combination is about 1.8 times the latter for the median worker.

[9] Classification change renders the series prior to 1989 less comparable to the series thereafter. The old classification criteria would yield higher unemployment rates since 1989. The difference can be several percentage points.

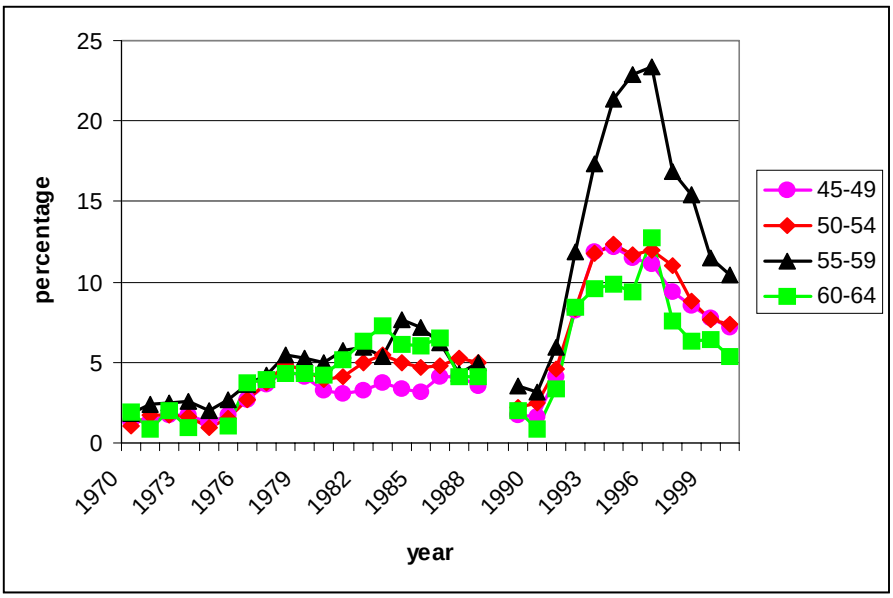

Figure 3: Unemployment Rates for Older Age Groups

efits (age group 55-59 in the figure). It, therefore, appears that the reduction in employment largely fell on the workers who suffered finacially least from unemployment. The unemployment rates are lower after the age sixty, because individuals in this age group are already in the unemployment pension. Without the financial incentives of the unemployment tunnel, it is difficult to explain why the unemployment rates for the fifty-five to fifty-nine year olds were more than ten percentage points higher in the nineties than the unemployment rates for the younger workers.

This difference does not occur in the previous decades. There was almost no difference in the unemployment rates of these age groups. Yet, the incentive structure has not substantially changed between the decades. This can also be shown by changing the x-axis from years to age - as in figure 4[10]. In the late 1980s and early 1990s, unemployment rates were similar in all age groups until the minimum age for the unemployment pension (60). During and after the recession, starting in 1992, there is a hump in the unemployment rates around

[10] Note that the figure 4 presents the unemployed of the age group whreas the figure 3 presents the unemployed of the labour force (the latter excludes pensioners). Therefore, the rates are not directly comparable.

the minimum age for the unemployment tunnel[11]. Hence, the incentives of the tunnel started to matter only since the recession.

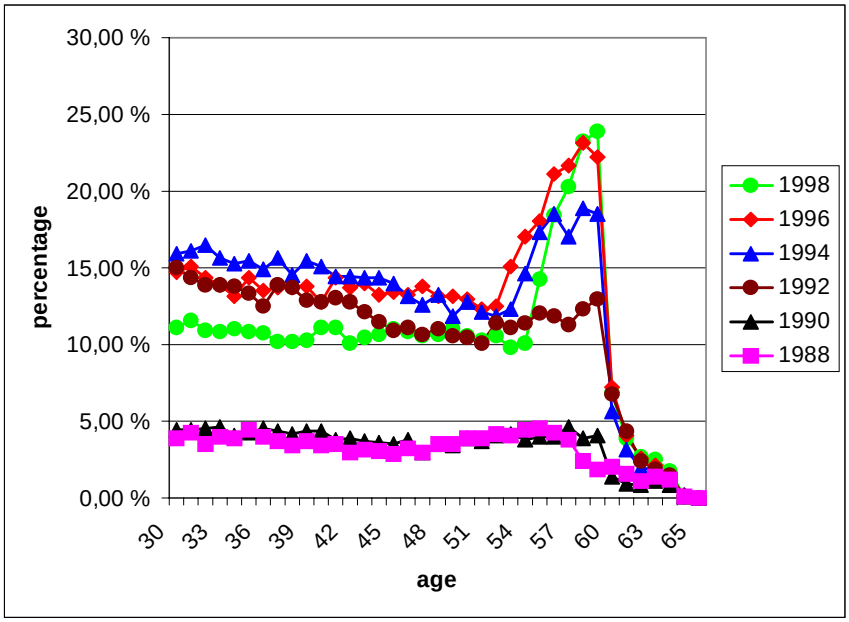

Figure 4: Unemployed by Age

To demonstrate that a job loss after the eligibility age for the tunnel often leads to permanent withdrawal from the labor market, we also looked at the labour market paths for a number of years after falling unemployed. In figures 5 and 6 we follow employees who lost their jobs in 1992. These employees were employed at the end of 1991, but unemployed at the end of 1992. The first figure (figure 5) is for those who were eligible for the unemployment tunnel (age groups of 54 to 64), and, the second is for a younger age group (40 to 45).

One year after becoming unemployed (that is, at the end of 1993), less than eight per cent of the older cohorts were re-employed (figure 5). The corresponding share of the younger age group is more than thirty-two per cent (figure 6). Over time, the share of the re-employed of the younger age cohorts increases. The reverse is true for the older age cohorts. Most unemployed in the older cohorts end up in the unemployment pension, and later in the old-age pension.

[11] Minimum age for the tunnel was 53 for the years prior to 1997, and 55 since then.

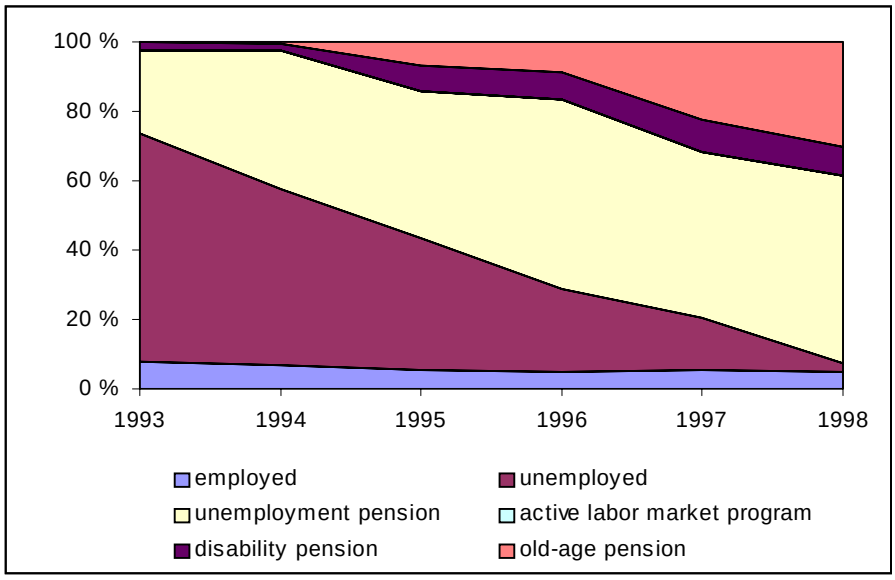

Figure 5: Labour Market States after Becoming Unemployment in 1992 (Employed in 1991) - Eligible for the Unemployment Pension Tunnel

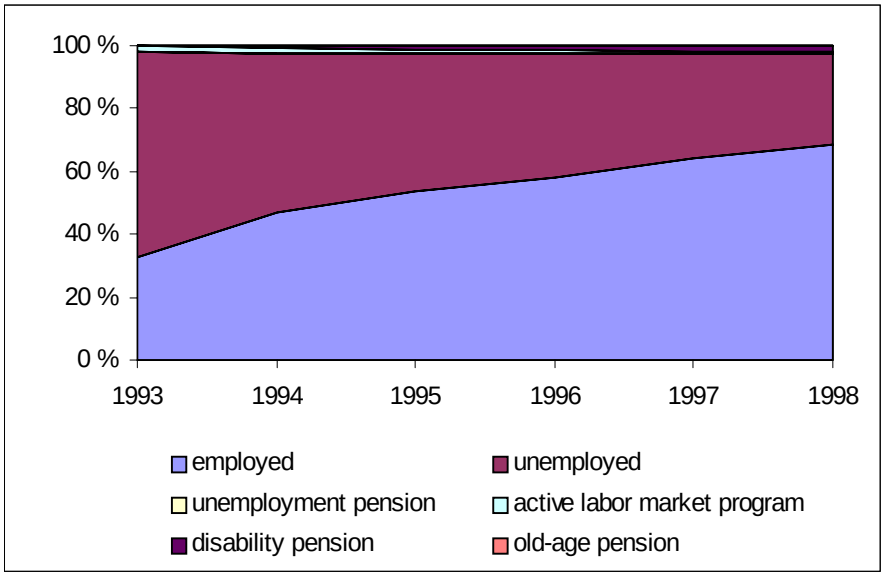

Figure 6: Labour Market States after Becoming Unemployed in 1992 (Employed in 1991) - Not Eligible for the Unemployment Pension Tunnel

Unemployment benefits are financed by unemployment insurance funds. The funds collect unemployment insurance contributions from employees and employers, and receive fiscal transfers directly from the government. Early retirement pensions are mainly financed by employer contributions[12]. Unemployment insurance contributions do not depend on the unemployment benefits received by the displaced workers of each firm. In contrast, unemployment and disability pension contributions are partially experience-rated. The degree of experience-rating depends on the firm size (number of employees). Small firms with less than fifty employees pay a fixed rate pension contribution, irrespective of how many of their employees retire. The largest firms, with more than thousand employees, pay the full cost of the disability pensions received by their former employees[13]. For the medium size firms, disability pension contributions are a weighted average of the flat rate of the small firms and the full liability of the largest firms. Liabilities for the unemployment pensions are calculated similarly, except that the maximum liability is fifty per cent of the pension benefit. This maximum applies to all firms with more than three-hundred employees[14].

In this section we stated that the displaced workers are eligible to the extended unemployment benefits and the unemployment pension at the age of fifty-five, yielding them a considerable change in the financial incentives at this age. We also showed that the unemployed rates jump at this age. We, therefore, concluded that the financial incentives have an impact on the timing of the labour market withdrawal. However, a pure labour supply explanation seems insufficient because the incentives mattered only in a recession. Therefore, the demand conditions must also play a role in the early retirements. Pure labour demand explanation is unsatisfactory, since it is hard to argue that the productivity of a worker suddenly falls at the age of fifty-five when the displacement probability is highest. Moreover, targetting the displacemtns to this age group seems irrational because these age groups yield an unemployment pension liability to firms. It would be cheaper for them to fire the younger workers. Yet, the firm behaviour can still be rational, if we assume that the firm takes into account the welfare of its employees. Because neither the supply side nor the de-

[12] Since 1994 also employees have paid a share of the pension contributions.

[13] In practise, this is done by setting the employers' disability pension insurance contributions according to the cost of disability pension payments.

[14] The experience rating was changed in 2000. Currently, both the disability and the unemployment pensions yield, at the maximum, an 80 per cent liability for the firm. Experience rating, however, doesn't, even today, extend to the unemployment benefit period.

mand side explanation is alone sufficient, we seek explanation in a model where firms and employees decide on early retirements co-operatively.

3 Implicit Contract Model for Early Retirements

To explain the stylized facts presented in the previous chapter we formulate an implicit contract model. The model is a simplification of the models presented by Hutchens (1999) and Arnott et al. (1988). Empirical implications of the model will be tested in the next section.

The model assumes risk-neutral firms and risk-averse workers, with no private information. These two parties, firms and employees, enter into a contract in the first period. In the first period, there is uncertainty about the productivity and the value of leisure in the second period. The contract specifies wages in both periods, firing rules and possible severance payments for the displaced workers.

In the second period, marginal product of labour (θ) and monetary equivalent of the workers' valuation of leisure (z) are publicly revealed. The firm then makes firing decisions based on this information. Marginal product of labor is a function of the aggregate demand conditions. We assume, without any loss of generality, that the marginal product can be either high (θ_H) or low (θ_L); each occurring with fifty per cent probability.

Government offers pension/social security benefits for the unemployed (g_u), out of which firms pay only a share (l_u). Moreover, each employee has an exogenous probability (d) of becoming disabled and obtaining a disability benefit (g_d). Firm pays a share (l_d) of this disability benefit.

All employees work in the first period. In the second period, if productivity is high, each firm retains its workers with certainty and pays them a wage (w_H). If productivity is low, the firm either keeps the worker and pays the worker a wage (w_L), or it fires him. Firing decisions are made each period prior to the incidence of disability. Below we denote the firing probability by p. Since all workers are identical, we could equally state that the firm fires a fraction p of its workers. Firm pays the displaced workers a severance pay (s). In the case of disability, individuals obtain a comparable lump sum payment (i). This can be thought of as a private disability insurance.

Firm maximizes profits taking into account workers' reservation utility and the disability risk. If the firm keeps a worker, and the worker is not disabled, the firm's profits are the difference between the marginal product of labour and the wage paid to the worker ($\theta_i - w_i$). If the worker is fired, the firm pays the

severance payment (s) and a fraction of the unemployment benefits ($l_u g_u$). The firm profits are then $-(s + l_u g_u)$. If the worker enters into disability, the firm similarly pays a private insurance (i) and a fraction of the disability benefits ($l_d g_d$). Hence, its profits are $-(i + l_d g_d)$. Firm's expected profits in the case of high and low productivity are given in equations 1 and 2.

$$\Pi_H = (1-d) * (\theta_H - w_H) - d * (l_d g_d + i) \quad (1)$$

$$\Pi_L = (1-p) * [(1-d) * (\theta_L - w_L) - d * (l_d g_d + i)] - (p) * (s + l_u g_u), \quad (2)$$

where Π_H are the profits in the high productivity case and Π_L the profits in the low productivity case. Rest of the notation was given above.

Worker's expected utility consists of three elements. If the worker is not fired and not disabled, he receives utility from wages ($U(w_i)$), where $U(.)$ is the standard utility function with $U\prime > 0$ and $U'' < 0$. In the case of disability, the worker receives the disability benefits (g_d), the insurance payment (i) and the value of leisure (z). If the worker is fired, he receives the unemployment benefit (g_u), the severance pay (s) and the value of leisure (z). Expected worker utility in low and high productivity scenarios is given in equations 3 and 4.

$$U_H = \int_z [(1-d) * U(w_H) + d * U(g_d + i + z)] f(z) dz \quad (3)$$

$$U_L = \int_z \{(1-p) * [(1-d) * U(w_L) + d * U(g_d + i + z)] + (p) * U(s + g_u + z)\} f(z) dz, \quad (4)$$

where U_H is the utility when productivity is high, and U_L is the utility when productivity is low. Rest of the notation was given above.

The optimal contract sets (p, s, i, w_H, w_L) to maximize profits. Hence, the firm maximizes $E(\Pi)$ subject to $E(U) = \overline{U}$ and $0 \leq p \leq 1$. Disability risk (d) is exogenous, and hence d is not a decision variable. The benefit levels for disability and unemployment (g_d, g_u), as well as the liability shares of the firm (l_d, l_u), are stated in law. So from the perspective of the firm, these are not decision variables. Lagrangean of the firm's maximisation problem is given in equation 5.

$$L = 0.5 * [(1-d) * (\theta_H - w_H) - d * (l_d g_d + i)] \quad (5)$$

$$
\begin{aligned}
&+0.5 * [(1-p) * [(1-d) * (\theta_L - w_L) - d * (l_d g_d + i)] - [p * (s + l_u g_u)]] \\
&+\lambda_1 * \{0.5 * \int_z [(1-d) * U(w_H) + d * U(g_d + i + z)] f(z) dz \\
&+0.5 * \int_z [(1-p) * [(1-d) * U(w_L) + d * U(g_d + i + z)] \\
&+p * U(s + g_u + z)] f(z) dz - \overline{U}\} \\
&+\lambda_2 * p \\
&+\lambda_3 * (1-p)
\end{aligned}
$$

The first order conditions are given in equations 6-10.

$$
\begin{aligned}
L_{w_H} &= -0.5 * (1-d) + \lambda_1 * 0.5 * (1-d) * U'(w_H) = 0 && (6) \\
L_{w_L} &= -0.5 * (1-p) * (1-d) + \lambda_1 * 0.5 * (1-p) * (1-d) * U'(w_L) = 0 && (7) \\
L_p &= 0.5 * [-(1-d) * (\theta_L - w_L) + d * (l_d g_d + i) - (s + l_u g_u)] + && (8) \\
&\quad \lambda_1 * 0.5 * [-(1-d) * U(w_L) - d * U(g_d + i + z) + U(s + g_u + z)] + \lambda_2 - \lambda_3 = 0 \\
L_s &= -0.5 * p + 0.5 * \lambda_1 * p * U'(s + g + z) = 0 && (9) \\
L_i &= -0.5 * d - 0.5 * (1-p) * d + \lambda_1 * 0.5 * [d * U'(g_d + i + z) && (10) \\
&\quad + (1-p) * d * U'(g_d + i + z)] = 0
\end{aligned}
$$

From 6, 7, 9 and 10, we see that the worker receives the same utility in each of the possible scenarios ($w_H = w_L = (g_u + s + z) = (g_d + i + z)$). Henceforth, a risk averse worker is fully insured against disability and unemployment risks as well as productivity shocks. This reflects the optimal insurance feature of the model.

Using the equalities above, equation 8 reduces to equation 11.

$$
L_p = [-(1-d) * (\theta_L - w_L) + d * (l_d g_d + i) - (s + l_u g_u)] + \lambda_2 - \lambda_3 \qquad (11)
$$

Furthermore, using ($g_u + s + z = w_L$) and the fact that the value of leisure (z) is the same for both the unemployed and the disabled, we can write equation 11 as 12.

$$
L_p = -(1-d) * \theta_L + (1-d) * z - d * (1 - l_d) * g_d + (1 - l_u) * g_u + \lambda_2 - \lambda_3 \quad (12)
$$

Since the Lagrange multipliers (λ_2 and λ_3) must be nonnegative,

$$(1-d)*\theta_L < (1-d)*z - d*(1-l_d)*g_d + (1-l_u)*g_u$$

implies that $\lambda_3 > 0$ and $(1-p) = 0$. Hence, the worker is fired with the probability of one. In contrast, if

$$(1-d)*\theta_L > (1-d)*z - d*(1-l_d)*g_d + (1-l_u)*g_u,$$

then $\lambda_2 > 0$ and $p = 0$. Hence, the worker is retained with certainty.

As the value of leisure (z) is an unobserved random variable[15], it useful to write the displacement rule as in equation 13.

$$z > \theta_L + \frac{d}{1-d} \times (1-l_d) \times g_d - \frac{1-l_u}{1-d} \times g_u \tag{13}$$

The worker is displaced if the value of leisure exceeds the threshold point given by the right hand side of the inequality 13. Denoting this critical value by k, the probability of displacement can be written as

$$P(z > k) = 1 - F(z), \tag{14}$$

where F is the cumulative distribution function of z.

The model yields straightforward predictions for the effect of the exogenous variables on the displacement probability. First and trivially, the probability of displacement depends negatively on productivity. Second, because all workers are retained in the high productivity case, the social security provisions affect retirement (displacement) only when the productivity is low. Third, if the firm is not fully liable for the unemployment benefits ($l_u < 1$), an *increase* in the unemployment benefits *increases* the displacement probability. In contrast, if the disability risk is positive ($d > 0$), and the firm is not fully liable for the disability benefits ($l_d < 1$), an *increase* in the disability benefit level *decreases* the displacement probability. Similarly, it can be verified that an *increase* in the firm liability share of the unemployment benefits, or a *decrease* in the firm liability share of the disability benefits, *decreases* the displacement probability.

Finally, the effect of the disability risk on the displacement probability can be derived. Differentiating the displacement rule with respect to the disability risk yields

[15] unobserved for us, not for the firm and the worker

$$\frac{\partial P(z > k)}{\partial d} = \frac{-(1 - l_d)g_d + (1 - l_u)g_u}{(1 - d)^2} \tag{15}$$

As the unemployment and the disability pensions are approximately equal, the sign of the derivative depends on the relative size of the firm liabilities for the unemployment and the disability benefits. If the firm liability for the disability pensions is higher (as it is for the big companies in Finland), an exogenous increase in the disability risk increases the displacement probability. The firm tries to avoid the more costly option, and preempts the increase in the disability risk by increasing its displacements.

The assumption of full information by both parties in the second period guarantees that the optimal contract yields efficient outcomes. A risk-averse worker is fully insured, and separations are efficient, because they occur only when the joint value of continuing employment (for the worker and the firm) is less than the joint value of the separation. However, the contract may be socially inefficient, since the contracting parties do not bear the full cost of the early retirement. This is shown by re-writing the displacement rule in equation 16.

$$(1 - d) * \theta_L + d * (z + (1 - l_d) * g_d) < z + (1 - l_u) * g_u \tag{16}$$

The left hand side contains the sum of the expected value of employment for both parties in the contract and the right hand side contains the value of the displacement. If there were no social security benefits ($g_d = g_u = 0$), or if the firms were fully liable for these benefits ($l_d = l_u = 1$), displacements are socially efficient, and occur only when the marginal product is less than the value of leisure ($\theta_L < z$). Unemployment benefits that are not fully experience-rated ($(1 - l_u) * g_u > 0$) may yield separations which are optimal for the worker and the firm, but not for the society as a whole ($\theta_L > z$). It is also possible that there are too few separations. That would happen if the disability risk was sufficiently high, and the firm liability for the unemployment benefits was much higher than the firm liability for the disability benefits.

4 Data and Estimation Results

4.1 Data

The data that is used in the empirical section come from a longitudinal linked employer-employee data set for Finland. This data set was created from Register of Enterprises and Establishments (REE), Financial Statements Statistics (FSS), and Employment Statistics (ES); all constructed and maintained by Statistics Finland.

Register of Enterprises and Establishments covers practically all Finnish enterprises and their establishments. It collects basic information on all companies subject to the value-added tax. The main purpose of this register is to serve as a sampling frame for company surveys. Financial Statements Statistics is a compulsory annual survey that collects corporate income statements and balance sheets of firms. FSS survey is a stratified sample of enterprises in REE. All large companies with more than one hundred employees are surveyed. Smaller companies are surveyed as a rotating sample where a fraction of the sampled companies is replaced each year. Employment Statistics is the annual census of the Finnish population. It is based on administrative registers, most important of which are the Population Register, Tax Registers, Employment Register of the Central Pension Security Institute, pension registers of the Social Insurance Institution and the Register of Job Applicants of the Ministry of Labour. ES contains a wealth of demographic information, detailed information on employment and unemployment spells, pension benefit information and annual income of the individuals. Most importantly, the ES contains the firm code which reveals the firm where the individual was working at the end of the year.

Linked panel was constructed by collecting all firms in manufacturing, construction, services and trade from the FSS survey. Comparable data was available in manufacturing and construction from 1989 to 1994, for services from 1990 to 1995, and for the trade from 1989 to 1995. The full sample contains 11,700 firms, with 4,000-6,000 firms each year. Indivduals from the ES were selected to the linked panel, if they had a firm identifier at the end of the year, at least in one of the years between 1988 and 1996. There were about two million employees who satisfied this condition in the ES data. About half of these individuals could be linked to the firms in the FSS survey. The data therefore excludes public sector employees, those individuals who were not employed at

the end of any of the years in the sample and individuals with missing firm identifier. If the individual could be linked to the firm data at least once, the rest of the information on him was collected from all available years (1987-1997), irrespective whether the firm link could be made every year. The data set is fully described in Korkeamäki and Kyyrä (2000).

For confidentiality reasons, Statistics Finland does not allow the use of the data set outside its premises. However, a smaller sample was released for the preliminary analysis. In this sample, firm identifiers were recoded, information on the largest companies was deleted, and noise was added to the balance sheet data. The final estimates were obtained from the full data set at Statistics Finland[16].

In this paper, we restrict the sample to the individuals who were between fourty-five and sixty-five years of age. Our unit of observation is an individual-firm-year combination. An individual is present in the sample in the years when he is employed in one of the companies and fullfils the age criteria. The final sample size was 953,365 person-firm-year observations, with 295,473 individuals. There are on average 3.23 observations per individual (maximum 7).

The dependent variable for our analysis is a transition from employment to unemployment. To be more specific, we define a transition to take place in the year t, if a worker who was employed in the last week of the year t, is unemployed in the last week of the year $t+1$. Explanatory variables for this transition are evaluated in year t.

Employee productivity (θ) is estimated from the firm data as output (value added) per worker. The value-added is calculated by subtracting cost of raw materials from sales, and adjusting this with the change in inventories[17]. When calculating the average productivity per worker, we used the average number of workers in the firm over the accounting period. We also experimented with adjustments to the productivity using the book-value of capital and within firm wage differences[18]. This did not influence the results.

[16] We thank Ossi Korkeamäki for running the programmes.

[17] Virtually the same results were obtained when the wages and rents were added to the gross margin of the firm.

[18] The purpose of the capital adjustment was to account for the differences in the capital stock between the firms. We deducted from the value-added the book value of capital multipied by the market interest rate. We also made an adjustment for within-firm productivity differences by multiplying the average worker productivity by relative wages within the firm. With these two adjustments, the worker productivity is $\widehat{\theta}_{it} = [Y_f - (r * K)]/(N) * (w_i/\overline{w})$, .where Y_f is the value added, r the helibor interest rate, K the book value of machinery and buildings,

As a measure of the demand shock faced by a firm, we used a change in the value-added. The change in the value-added was simply a percentage change in the value-added without any correction for inflation. Differencing the data reduced the sample size because not only we lost one year in differencing but also there are plenty of firms that do not appear in the data more than once.

4.2 Results

In our implicit contracts model the firm decides on early retirements by comparing the expected profits and the expected costs of retaining its workers. The contract makes the worker indifferent between retiring and continuing in employment. Social security benefits influence the retirement decision by subsidizing displacements. If the worker is eligible for the unemployment benefits or the unemployment pension, displacent costs for the firm are reduced and the displacement probability increases. Firm liability for the benefits also plays a role. Higher is the firm liability for the unemployment benefits, more expensive are the displacements, and lower is the displacement probability.

In the model we specified the displacement decision as a once-and-for-all decision. In reality the firm has an option of delaying displacements until there is more information on the product demand conditions. A seemingly natural way of modeling such a dynamic process would be a dynamic programming model. The firm would update its expectations of the future productivity in each period. It would displace a worker when the expected stream of the future profits falls below the expected costs of displacement[19]. Yet, a dynamic programming model has to make a number of assumptions on, for example, the expectation formation mechanism of the firm, discount rates of the firm, and possibly different discount rates of the worker. In addition, stream of the unemployment and pension benefits would have to be calculated for each worker at each possible retirement age. As the benefits depend on the pre-retirement earnings, we would also have to model the individual wage expectations or forecast the individual earnings.

Here we do not attempt to estimate a dynamic programming model. Instead, we try to confirm some of the model predictons using a reduced form approach[20].

N the number of workers, w_i the individual monthly wage and $\overline{w}$ the firm average wage.

[19] The model would be similar to the dynamic programming models that analyze the retirement decisions from the worker's perpective (e.g. Stock and Wise 1990 or Rust and Phelan 1997).

[20] We plan to construct a dynamic programming model in the future in order to make predictions on the effects of some of the proposed changes in the firm liabilities and pension

First, we show that displacements are more common in firms that are hit by a demand shock. More interestingly, we also show that the incentives created by the social security system, have a larger effect on the workers that are in the firms hit by a negative demand shock. Displacements are therefore more targetted when the demand conditions are bad. Second, we show that the size of the firm pension liability has an effect on the displacements.

The worker incentives to retire depend on the expected stream of wages and benefits (unemployment benefits+pensions). An additional year of work may increase pensions, depending on the worker´s age, wage, and the eligibility rules of the different pension schemes. However, by far the largest increase in the benefits occurs when the worker turns fifly-five and becomes eligible for the unemployment tunnel (see table 1 in section 2). In section 2 we also showed that the displacement rates increase dramatically at this age. In this section, we show that this increase depends crucially on the product demand conditions of the firm.

We use the change in output (value-added) as an indicator of the demand shock, and divide the workers into four quartiles, based on the output change of their firms. We do this separately each year so that, for example, in 1990 the workers in the first quartile were in firms where output *decreased* by at least 5.5% and the workers in the fourth quartile were in firms where output *grew* by at least 12.4%. We estimate the effect of the incentives by running simple probit models where the probability of displacement is explained by the tunnel eligibility. This is done separately for each quartile and each year.

Table 2 shows the marginal effects of the eligibility dummy in the estimated models. Marginal effects are obtained by scaling the probit coeffiecients so that the entries refer to the change in the probability of displacement due to the tunnel eligibility. In square brackets, below the marginal effects and their standard errors, are the fractions of workers who were actually displaced in each firm-year category.

The fraction of displaced workers appears to be inversely related to the output change of the firm. Across the years, firms with the lowest output growth (column I) displace most workers. The effect of the tunnel eligibity is positive and statistically significant in all output growth quartiles in all years. In other words, workers who are eligible for the extended unemployment benefits, are

accruals.

clearly more likely to end up unemployed.

Interesting results in the table are the differences in the effect of the tunnel eligibility across the years and across the firms with different output growth. The effect of the tunnel eligibility before the recession in 1990, was rather small. Workers who were eligible to the tunnel, were three to five percentage points more likely to be displaced than their ineligible co-workers. In contrast, in the first years of recession, 1991-1992, eligibility to the unemployment tunnel increased the displacement probability by approximately ten percentage points. There is also a clear pattern within each year. The tunnel eligibility increased the displacement probability in the firms with low output growth (quartiles I and II) much more than in firms with higher output growth.

These results are surprisingly consistent over the whole period. They do not change when we control for a number of firm and individual specific characteristics. In the right hand side of the table, we estimate the same model but control for sex, education, annual earnings, industry, firm size, average wages and the labor share of the value-added in the firm. We find that women are less likely to be displaced. Education does not seem to have a large effect. High wage has a significant negative impact on the displacement probability. As for the firm characteristics, we find that workers in large firms have a lower and workers in the construction industry a higher displacement probability. Average wages in the firm do not have a significant effect, but the workers in labor intensive firms have a larger displacement probability. (Results are not presented here, but they are available from the authors upon request). Adding all these control variables decreases the effect of the tunnel eligibility by about one percentage point. Yet, the controls do not affect the pattern of the results. Incentives created by the unemployment tunnel have clearly the largest effect on displacement in the firms with the lowest output growth, and these effects are largest during the recession.

The output change is probably the best available indicator of the demand shocks faced by the firm. However, as our model is defined in terms of productivity shocks, we also estimated similar probit models, classifying the firms by average worker productivity. Again, we divided the data into four quartiles, now based on the productivity levels, and studied the effect of the tunnel eligibility in each quartile. Our model predicted that the tunnel eligibility should have the largest effect on displacement in the firms with the lowest productivity.

	Without	controls			With	controls		
	worst			best	worst			best
	I	II	III	IV	I	II	III	IV
90	.058	.030	.041	.038	.047	.026	.035	.031
	(.003)	(.003)	(.003)	(.003)	(.003)	(.002)	(.003)	(.003)
	[.100]	[.056]	[.074]	[.106]	[.099]	[.056]	[.074]	[.106]
91	.117	.109	.064	.069	.108	.100	.058	.061
	(.004)	(.004)	(.003)	(.003)	(.004)	(.004)	(.003)	(.003)
	[.143]	[.146]	[.091]	[.079]	[.143]	[.146]	[.091]	[.079]
92	.126	.100	.083	.089	.117	.090	.079	.080
	(.004)	(.004)	(.003)	(.003)	(.004)	(.003)	(.003)	(.003)
	[.176]	[.101]	[.088]	[.073]	[.176]	[.101]	[.088]	[.073]
93	.096	.088	.048	.042	.085	.081	.043	.048
	(.004)	(.003)	(.002)	(.003)	(.004)	(.003)	(.002)	(.002)
	[.112]	[.062]	[.039]	[.043]	[.111]	[.062]	[.039]	[.043]
94	.099	.071	.055	.088	.088	.060	.047	.080
	(.003)	(.003)	(.003)	(.003)	(.003)	(.003)	(.002)	(.003)
	[.078]	[.048]	[.044]	[.088]	[.077]	[.048]	[.044]	[.070]
95	.068	.056	.039	.045	.056	.051	.036	.040
	(.006)	(.006)	(.005)	(.006)	(.006)	(.005)	(.004)	(.005)
	[.067]	[.051]	[.039]	[.061]	[.066]	[.051]	[.039]	[.061]

Table 2: The effect of unemployment tunnel by quartiles of sales growth

Notes: Entries in the table are changes in the firing probability due to the eligibility to the extended unemployment benefits. Estimates are based on probit equations that are estimated separately in each quartile and year. In columns labeled "with controls" regressions also include controls for sex, education, earnings, industry, firm size, average wages in the firm and labor share of the value added in the firm. Standard errors of the estimates are in parenthesis. The numbers in square brackets are the average fraction of workers in each group that become unemployed.

In table 3 we show that the effect of the tunnel eligibility is the highest in the firms with the lowest productivity levels. Moreover, also in this table the effect is strongest during the recession. The time dimension of the table 3 captures again the radical changes in the cyclical conditions in Finland in this period. 1989 to 1990 were years of a strong cyclical upswing, 1991 to 1994 a historically deep recession and from then on, there was a swift recovery (see figure 3). These are reflected also in the average firing probabilities. Only four per cent of the employees in the lowest productivity firms in 1989 were displaced, whereas in 1992, the lowest productivity firms displaced seventeen and a half per cent of their employees. For the highest productivity firms, the corresponding figures were a bit more than one per cent in 1989, and almost seven per cent in 1992. If the coefficients for the tunnel regressions are compared across these years, the results also confirm the prediction that the incentives matter more in the "hard times". Tunnel eligibility has a stronger effect in the years of the recession and in the low productivity firms. Also these results are robust to observable firm and worker characteristics.

The second prediction of the theoretical model that we wanted to test was the importance of the firm liabilities on displacements. Our model predicted that higher the firm liabilities are for the unemployment benefits and the unemployment pension, the lower is the displacement probability. As mentioned in section 2, in Finland, the liability for the unemployment pension depends mainly on the firm size. Bigger firms have a higher liability for the unemployment pensions, and could, therefore, be expected to be more reluctant to displace their older workers. Yet, big firms also have a higher liability for the disability pension. As disability pensions are very common, the risk of a disability pension liability is high. Since the unemployment pension liability is capped at fifty percent of the total cost of the unemployment pension, but there is no such cap on the cost of the disability pension, the unemployment pension is typically cheaper of the two for the biggest firms. Becausae the unemployment benefits are not experience-rated at all, the cost difference between the disability and the unemployment pensions is even higher when comparing all expenses of the exit routes rather than just the pensions. For example, a firm that displaces a worker at the age of fifty-five, becomes liable for the worker benefits only when the worker starts receiving the unemployment pension at the age of sixty. If the same worker became disabled at the age of fifty-five, the firm would be liable for

	Without	controls			With	controls		
	worst			best	worst			best
	I	II	III	IV	I	II	III	IV
89	.015	.006	.008	.005	.013	.004	.006	.003
	(.002)	(.002)	(.001)	(.001)	(.002)	(.002)	(.001)	(.001)
	[.041]	[.034]	[.019]	[.013]	[.041]	[.034]	[.019]	[.013]
90	.048	.040	.050	.025	.044	.037	.044	.017
	(.003)	(.003)	(.003)	(.002)	(.003)	(.003)	(.002)	(.002)
	[.114]	[.086]	[.078]	[.052]	[.113]	[.086]	[.078]	[.052]
91	.094	.081	.104	.083	.093	.080	.092	.072
	(.004)	(.003)	(.003)	(.003)	(.004)	(.003)	(.003)	(.003)
	[.156]	[.127]	[.111]	[.073]	[.156]	[.127]	[.111]	[.073]
92	.114	.108	.093	.090	.112	.104	.086	.082
	(.004)	(.003)	(.003)	(.003)	(.004)	(.004)	(.003)	(.003)
	[.175]	[.120]	[.087]	[.068]	[.175]	[.120]	[.087]	[.068]
93	.086	.080	.051	.068	.081	.070	.045	.063
	(.004)	(.003)	(.002)	(.003)	(.003)	(.003)	(.002)	(.003)
	[.103]	[.072]	[.042]	[.040]	[.102]	[.072]	[.042]	[.040]
94	.091	.094	.065	.065	.088	.084	.060	.056
	(.004)	(.003)	(.003)	(.002)	(.003)	(.003)	(.002)	(.002)
	[.103]	[.062]	[.044]	[.037]	[.103]	[.062]	[.044]	[.037]
95	.078	.046	.059	.041	.073	.046	.054	.032
	(.006)	(.006)	(.005)	(.005)	(.006)	(.005)	(.005)	(.004)
	[.083]	[.064]	[.047]	[.034]	[.082]	[.064]	[.047]	[.034]

Table 3: The effect of unemployment tunnel by quartiles of productivity

Notes: Entries in the table are changes in the firing probability due to the eligibility to the extended unemployment benefits. Estimates are based on probit equations that are estimated separately in each quartile and year. In columns labeled "with controls" regressions also include controls for sex, education, earnings, industry, firm size, average wages in the firm and labor share of the value added in the firm. Standard errors of the estimates are in parenthesis. The numbers in square brackets are the average fraction of workers in each group that become unemployed.

the disability pensions for the whole ten year period (55-65) when the worker receives the disability pension. This difference in the liabilities may encourage big firms to increase their displacements at the age when the disability risk increases.

Because the difference between the firm liability for the disability and the unemployment pension is a reasonably smooth function of the firm size, it is difficult to identify the effect of the firm liabilities empirically. Further identification problems arise because the firm size is likely to affect a number of other features of the employment contract. Pure effect of the firm size on the displacement probability is therefore not sufficient evidence on the importance of the firm pension liabilities. For this, we provide additional evidence on the effect of the firm liabilities indirectly, making use of an exogenous change in the disability risk. In 1994, the eligibility age for the individual early retirement changed (individual early retirement is one of the two disability pensions described in section 2). Previously individual early retirement could be granted to fifty-five to sixty-four year olds. After the change, only fifty-eight to sixty-four year olds were eligible. Because of the change cohorts born by 1939 could retire on individual early retirement in 1994, but the cohort born in 1940, could not go into individual early retirement until 1998. Effectively, this change in the minimum age requirement reduced the disability risk for the age groups that were no longer eligible for the individual early retirement. These age groups could still immediately retire on the "normal" disability pension. Yet, this pension has more stringent medical criteria (see section 2). In our model (see equation 15), an increase in the disability risk increases the displacement probability in firms where the liability for the disability pensions is higher than the liability for the unemployment pensions. Therefore, we could expect that the eligibility for the individual early retirement had a more positive effect on the displacement probability in the large firms. In other words, because the disability risk for the cohorts born in and after 1940 decreased in 1994, we would expect that also the displacement probability fell for the same cohorts.

In table 4 we examine the effect of the firm size and the eligibility to the individual early retirement on the displacement probability. In the first column we regress displacements on the indicators that the worker is at least fifty-four years old (eligible to the individual early retirement in the following year prior the individual early retirement reform), the worker was born before 1940 (not

affected by the change in the legislation), the firm size, and the interactions of these variables.

Unsurprisingly, we find that older workers are more likely to be displaced. The firm size appears to have a positive effect on the displacement probability. Bigger ther firm, more likely is the displacement. This effect, however, is not robust to other controls. Interaction terms show more interesting effects. We find that when workers reach the eligibility age for the individual early retirement, the displacement probability grows more in larger firms (coefficient of the interaction term between the age dummy and the firm size is positive). This would confirm the prediction of our model. Increased risk of the disability pension liability may indeed encourage firms to fire older workers.

Yet, as noted above, identifying the effects of the firm liabilities from the differences in displacement probabilities in firms that differ in size, is questionable, since the firm size may affect the displacement probability for various other reasons than for the pension liabilities[21]. Therefore, in column 2 we provide further evidence. We include a full set of age and year dummies to the estimated regression. We also add a triple interaction term between the firm size, age and cohort, in order to capture the effects of the changes in the eligibility criteria for the individual early retirement in 1994. We argued that if the firm liabilities have an effect on the displacement probability, the displacement probability should grow more in large firms when the workers reach the age of fifty-five (Coefficient of the interaction term between the firm size and the age dummy should therefore be positive). Furthermore, this effect should be stronger when the workers are eligible for individual early retirement, that is when the risk of disability liabilities for the firm is larger. Therefore, we expect that the coefficient of the triple interaction term between the firm size, the age dummy and the cohort dummy should be positive. Results in the table seem to confirm our expectations.

As the eligibility for the individual early retirement is really a cohort specific and not a year specific rule, it might be more appropriate to control for the differences across the cohorts than across the years[22]. In column 3, we replace the year dummies by a set of cohort dummies. The main results are not affected

[21] For example, it is possibile that the large firms have more choice over who to fire. Therefore, bigger firms may be more able to use the early retirement provisions in reducing the size of their labour force.

[22] Obviously we cannot include all age, cohort and year dummies in the equation.

	Coef (s.e.)	Coef (s.e.)	Coef (s.e.)	Coef (s.e.)
(age≥54)	0.036			
	(.003)			
(birth<1940)	0.009			
	(.001)			
firm size	0.011	-0.072	-0.006	0.007
	(.001)	(.001)	(.016)	(.015)
(age≥54)*(birth<1940)	0.019	-0.020	0.026	0.025
	(.003)	(.003)	(.004)	(.003)
firm size*(birth<1940)	-0.004		-0.002	-0.002
	(.000)		(.000)	(.000)
firm size*(age≥54)	0.026	0.032	0.038	0.026
	(.003)	(.013)	(.014)	(.013)
firm size*(birth<1940)*(age≥54)		0.030	0.024	0.032
		(.013)	(.014)	(.013)
age dummies	no	yes	yes	yes
cohort dummies	no	no	yes	yes
year dummies	no	yes	no	no
individual controls	no	no	no	yes
firm specific controls	no	no	no	yes
number of person years	953,365	953,365	953,365	953,365
observed probability	0.077	0.077	0.077	0.077
Pseudo R^2	0.037	0.068	0.049	0.101

Table 4: The Effect of the Individual Early Retirement Age Limit Change on the Displacement Probability

Notes: Entries in table are marginal effects, that is changes in the displacement probability when the expalatory variables change by one unit. Firm size is divided by 1000. Standard errors of the marginal effects are in parenthesis. They are robust for clustering of repeated observations of the same individual.

by this change. The estimates of the interaction terms in column 3 are very close to the estimates in column 2. Results appear to be robust also to a number of individual and firm specific controls. In column 4, we add controls for sex, education, annual earnings, industry, firm size, average wages and the labor share of the value-added in the firm. The main results do not change. When workers turn fifty-five, the displacement probability grows more in the larger firms. This effect is stronger for the cohorts that have the highest disability risk.

5 Conclusion

Observation that the firm liabilities for the unemployment benefits affect the layoff decisions, is not new. Feldstein (1976, 1978) and Topel (1984) show that imperfect experience-rating of the unemployment benefits effectively subsidizes the lay-off decisions, and therefore increases the incidence of unemployment. Hutchens (1999) constructs a theoretical model applying this idea to early retirement. To our knowledge, the effect of the firm liabilities on early retirements has previously not been tested empirically. As many early retirement schemes, particularly in the European countries, share features of the unemployment insurance programs, accounting for the firm incentives in the early retirement decisions is crucial.

A negative shock to the worker productivity may force firms to reduce their employment. In the implicit contract framework, firms arrange their displacements so that the losses to the workers are minimized. Therefore firms encourage those workers who are eligible to the unemployment tunnel, to take this early retirement. The worker incentives to retire are not better in the bad times, but if the firm has an active role in the retirement decisions, early retirement schemes are jointly more profitable for the worker and the firm when the productivity is low. In the good times, because the firm wants to keep all of its workers, the financial incentives have a smaller effect on retirement.

Data requirements for the exercise of this paper are substantial. To model jointly the behavior of the firm and the worker, the data must contain information on both parties. A basic requirement is that the transitions from employment to unemployment and early retirement can be traced, and there is some exogeneous variation in the firm and the worker incentives. As individual level productivity measures are rarely available, the data must contain enough financial information on firms so that at least the average productivity of the workers in each firm can be estimated. Increasing availability of linked employee-employer data sets makes these type of calculations possible.

There are a number of possible extensions to the analysis performed in this paper. We have considered disability as an exogenous risk that affects the employment contract. It could be argued that the disability risk is not exogenous, but also depends on the financial incentives of the worker and the firm. It should be reasonably straightforward to extend the model so that the workers and firms

maximize joint profits by choosing between three options: employment, retirement on either unemployment or on disability pension.

Another obvious extension would be to replace the once-and-for-all decision with either a dynamic programming model (as in, for example, Rust and Phelan, 1997) or an option value model (Stock and Wise, 1990). Either of these extensions would make the model more realistic by allowing the firms to postpone the displacement decision, still keeping the option to lay-off the worker in the next period if the demand conditions do not improve.

The model could also be made more realistic by dropping the full information assumption. Full information on workers' valuation of leisure allowed the firms to tailor-make the individual retirement benefits. While this would force the firms to offer the same benefits to all of their workers (taking account of the expected value of leisure for the worker), it would not change the key prediction of the model: both the worker and the firm incentives matter for the early withdrawal from the labour market.

As population ages and the labor force participation rates for the aged have decreased, many countries face serious challenges of funding their pension systems. There is a widespread consensus that the best alternative would be to increase the average retirement age. We show that in addition to improving the worker incentives, an increase in the average retirement age might also require tampering with the implicit incentives provided to the firm. Experience-rated unemployment benefits and unemployment pensions would lessen the firm incentives to fire older workers. Full experience-rating should, however, be used with caution, because it could further discourage hiring of the older workers, and/or shift the displacements excessively to other age groups.

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A APPENDIX

Descriptive Statistics Descriptive statistics of the sample are in table 5. These statistics are calculated over the whole sample. The unit of the observation is person-year. Some individuals appear several times in the sample whereas some others appear only once. As stated in the text, the data for manufacturing and construction was available from 1989 to 1994, for services from 1990 to 1995 and for trade from 1989 to 1995.

Variable	Mean	Sd	Min	Max
Age	50.95	4.56	45	64
Year of birth	40.65	5.02	25	50
Earnings (FIM/year)	131,432	82,289	0	5,453,710
Productivity (FIM/year)	277,297	221,603	$-3.1*10^7$	$4.6*10^7$
Firm size (number of co-workers)	1,966	2,655	0	13,678
Years of Education	10.34	2.01	9	22
Female	0.42	0.49	0	1
Labour share in a firm	0.67	0.47	0	1
Transition from employment to unemployment	0.08	0.27	0	1
Average wage in a firm	120,055	28,673	102	845,657
Change in the value-added (%)	12.59	435.86	-36405	51802
Eligible to the IER	0.27	0.45	0	1
Eligible to the unempl tunnel	0.41	0.49	0	1
Works in manufacturing	0.64	0.48	0	1
Works in construction	0.07	0.25	0	1
Works in services	0.05	0.22	0	1
Works in trade	0.25	0.43	0	1
Number of observations	1,001,638			

Table 5: Descriptive Statistics

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