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## The determinants of occupational pensions

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# MEMORANDUM

No 01/2006

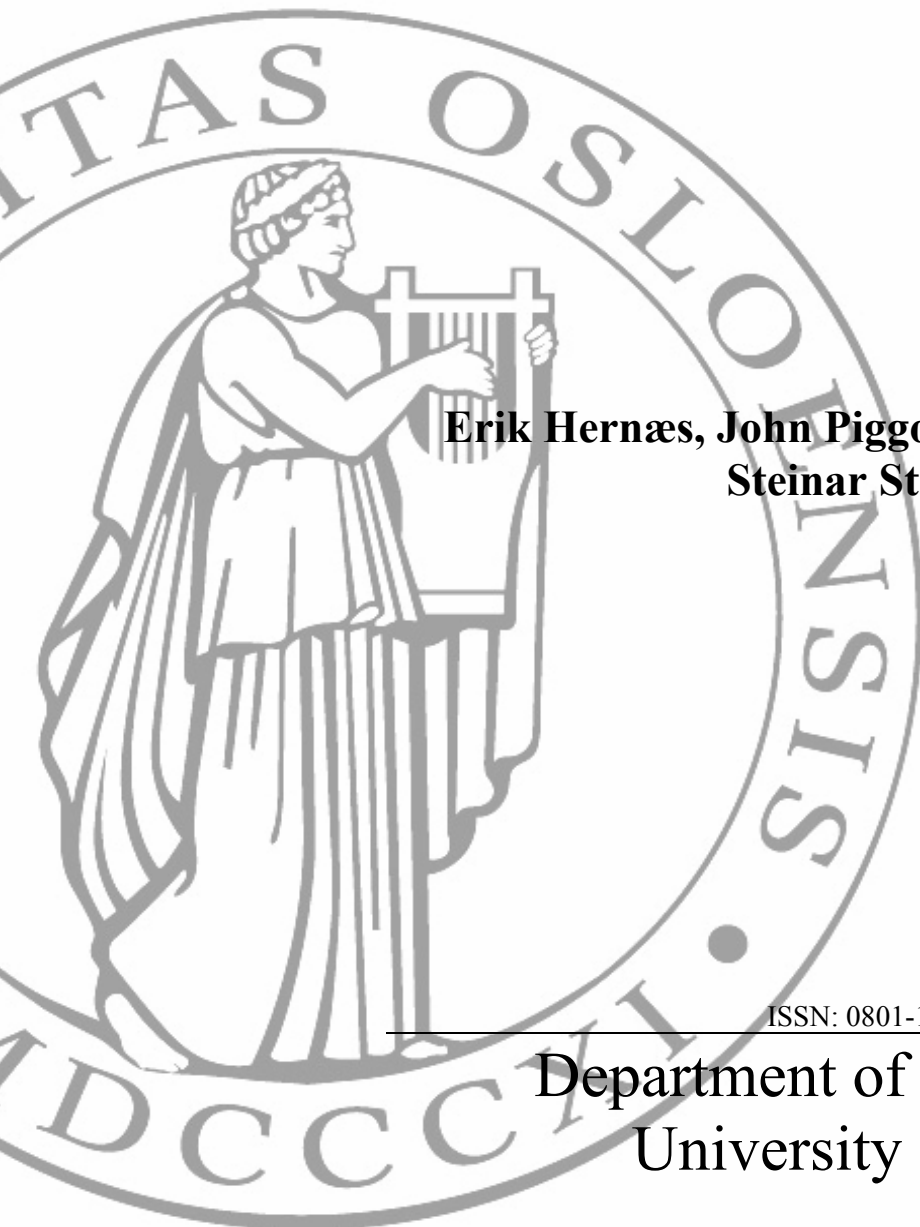
## The Determinants of Occupational Pensions

**Erik Hernæs, John Piggott, Tao Zhang and  
Steinar Strøm**

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5 January 2006

# The Determinants of Occupational Pensions<sup>1, 2</sup>

*Erik Hernæs<sup>3</sup>, John Piggott<sup>4</sup>, Tao Zhang<sup>5</sup> and Steinar Strøm<sup>6</sup>*

## *Abstract*

The decision by firms to offer an occupational pension is investigated with a unique linked employer-employee dataset, supplemented with detailed actuarial calculations of the cost to the firms of offering occupational pensions and constructed tax gains from pension contributions versus cash wage, driven by lower tax on wages than on pensions. The tax gains which can be shared between employers and employees by the degree of wage moderation, are clearly associated with the occurrence of an occupational pension plan. An occupational pension is associated with longer average tenure in the firm. Occupational pensions typically are found in large firms, and individual wage negotiations, a high degree of unionization and requirement of long training are all positively associated with an occupational pension. Hence, financial and productivity incentives are found to operate within a moderating institutional framework.

*JEL:* C25, D21, G23,

*Keywords:* Occupational pensions, tax gains, tenure, linked employer-employee datasets

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# 1. Introduction

This paper re-visits the literature on the pension decision – that is, the decision by firms to offer a pension plan to its employees. In many countries, occupational pensions (OP) are being slated to play a more prominent role in the pattern of retirement provision, as demographic transition bites and governments seek to reduce public pension commitments. They are seen as a natural vehicle for income replacement, particularly for those above average earnings. The institutional framework for such pensions is legislated by the authorities, but the decision of whether to offer a pension is a private sector decision.

Yet there is limited research on why firms offer pension plans, and in particular why some firms do, and others do not. Horiba and Yoshida (2002) is an exception, following 488 Japanese firms listed on stock exchanges between 1980 and 1990. For the firms introduction of an occupational plan was voluntary<sup>7</sup> and seemed to be motivated by economic incentives and influenced by union attitudes. An analysis based on measurement of the financial incentives which is a main feature of this paper, appears not to have been carried out until now.

US based literature focuses on two possibilities. First, tax deductibility of pension accumulations may make compensation in the form of pension contribution more cost-effective than direct wage payments. Second, backloading labour compensation may generate a more stable and productive workforce. The attractiveness of pension contribution compensation is discussed by Gustman et al (1994), who identify both worker side and firm side motivations. Economies of scale, union preferences and tax gains, may all play a role, in addition to recruitment and employee motivation effects.

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<sup>7</sup> It may in part be a formalization of looser arrangement and therefore not an entirely new benefit

Direct evidence on productivity effects, for instance that productivity gains may result from accumulation of firm-specific human capital as hypothesized by Cornwell and Dorsey (2000) is hard to come by. However, a recent study by Decressin *et al* (2005) find a positive effect on productivity of offering benefit (often a pension plan).

Evidence on the relationship between turnover or tenure, and occupational pensions is found in several studies. Gustman and Steinmeier (1993)<sup>8</sup> found that workers are three times more likely to separate from jobs that do not provide pension coverage than from jobs that do provide coverage. Gustman *et al* (1994) note: ‘the finding that worker turnover is only about half as high for workers without pensions.’ The occurrence of a plan appears to be the important thing. Further evidence comes from Ippolito (1991) who found that pensions increase tenure in a firm, on average, by 20%. Later, Ippolito, (1997) advances the theory that firms match employee contributions in 401 (k) plans (in our case offer an OP) to attract ‘stayers’. Even and Macpherson (1996) found pension coverage to reduce turnover, and more so in large firms.

The expectation of a more pervasive role for occupational pensions in providing adequate financial support for retirees suggests that this question requires renewed attention. If heavy reliance is to be placed on occupational pensions as a source of retirement finance, then it is important that the determinants of this decision are well understood. In many countries, less than half the workforce is covered by an occupational pension, and typically, only a minority of firms offer pension benefits.

This study exploits a unique data base of firms and workers in Norway to explore this question. The database combines administrative records of all workers in Norway stretching back 12 years, with a firm survey, undertaken in 2003. Detailed information about workers

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<sup>8</sup> Cited in Johnson (1994)

and their employment history are matched to a large and representative survey of firms, with an array of questions about organization, wage negotiations, whether a pension plan is offered, and at what replacement rate. Because firm data is linked with the socioeconomic characteristics of employees, we are able to calculate for each employee the direct cost to the employer of a pension plan. Using observed earning and detailed tax rules, we then calculate potential tax gain for each employee and for the firm from an occupational pension contribution, compared to the same amount from the firm in the form of a wage increase.

Analysis of this data set suggests that several stylised facts about occupational pensions in the US are replicated in Norway. Occupational pension plans are more frequently offered in firms that are large and whose workers require long training, and are facilitated by the degree of unionisation and by local and individual wage negotiations. The tax gains from a pension plan appear to have a significant and strong positive effect on the probability that a firm will have an occupational pension. We pay special attention to this, both because of its evident importance as an explanatory factor, and because of the potency of tax policy in modifying firm behaviour. We also find, like Ippolito (1991) that tenure is approximately 1 year longer around a mean of 5-6 years in firms with an OP and that this is a motivating factor for offering an OP.

Section 2 gives a brief overview of pension and retirement landscape in Norway. In Section 3 we describe the data set, which has applications far beyond the analysis of pensions. In Section 4 we describe the pension cost and tax gain calculations used in the study. We present the model in Section 5 and the results in Section 6. Section 7 concludes.

## 2. Norway's Pension Landscape

### Policy Structure

The backbone of Norway's retirement provision system is a pay-as-you-go unfunded defined benefit plan, the National Insurance System (NIS), available from age 67. The system is organized around a unit called the basic amount (G), currently at 55 000 NOK<sup>9</sup>. It consists of a basic pension and an earnings related pension. The earnings related pension is based on the average of the highest 20 years of earnings, with benefits set at 42 % of earnings between 1 and 6 G and 14 % of earnings between 6 and 12 G. The NIS is therefore very progressive and redistributive. The public sector has its own pension system, with 66 % pension of final salary, fully integrated with the NIS.<sup>10</sup>

### Structure and tax treatment of occupational pensions (OP)

In addition to the NIS, firm based occupational pensions are widespread. In 2001, 85 per cent of recent retirees received an occupational pension, adding an average of about 30 per cent to their NIS pension. An OP is most often found in large firms and in certain industries. Until 2001, only contributions to occupational pensions which were of the defined benefit type and which also complied with specifications in the legislation on these pensions, qualified as a tax deductible cost. As a consequence, almost all pensions were of this type. During our observation period, regulations also required that all employees who were working at least half normal time and for at least one year should be covered.

Occupational pensions are designed to supplement the NIS pension and target a (total) replacement rate defined as the sum of pre tax NIS and occupational pension divided by final

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<sup>9</sup> In January 2006, the exchange rate was around 6.7 NOK per US\$

<sup>10</sup> An overview of the Norwegian National Insurance System can be found in "The Norwegian Social Insurance scheme" (2005), an abstract of the pension reform proposal by the Government in "Summary of Report No. 12 (2004-2005) to the Storting" (2005) and an abstract of a preceding commission's report in "Main aspects of the Pension Commission's proposals" (2004).



salary. The replacement rate cannot exceed 70 % nor can it increase with earnings within the firm.<sup>11</sup> The predominant replacement target is 66 per cent (Pedersen, 2000).

It should be noted that these target replacement rates are used to set the OP, based on a stipulated NIS pension. Deviation in realized NIS will cause the realized replacement rate to deviate from the target rate.

OP pensions bridge the gap between the NIS pension and a proportional total pension. This means that the OP regime reverses the redistribution inherent in the NIS pension, and that the direct cost of an occupational pension rises with the wage level, not only in absolute but also in relative terms.

In addition to the old-age pension, these programs usually include disability insurance and survivor benefits, which constitute between 30 and 40 per cent of total cost.

For firms, contributions are treated like wages for tax purposes. For employees, pensions are taxed under an EET paradigm (contributions and accumulation tax Exempt and benefits Taxed under the income tax.)<sup>12</sup> Some companies require contributions from the employee, often mimicking the public sector by deducting 2 per cent of ordinary wages.

The law requires funds in an OP to be separated from the legal entity of the company, either in a separate pension fund or by a contract with an insurance firm. In either case, the cost for the company is calculated annually as the difference between present values of projected liabilities and accumulated assets. Annual contributions aim at balancing the two. These principles are set out in detail by Hernæs and Zhang (2005) where we describe how we have calculated costs for all employees.

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<sup>11</sup> It can decrease, but never in practice does

<sup>12</sup> Tax rates on pension income are lower than tax rates on income from work.

### **3. Data sources**

We discuss in turn the administrative data on individuals and the firm surveys.

#### **Administrative register data**

Register data received from Statistics Norway are administrative records collected for statistical and research purposes. A unique personal identification number for each resident in Norway allows linking over time and across registers. The data give information on gender, age, marital status, education, spells of work, employer, spells of unemployment, spells of sickness, spells of disability, retirement and income from work and social benefits. The data also gives links between spouses. Currently the data cover the period 1992-2002, and include the vast majority of employed workers in Norway. They provide a uniquely rich data set of labour force characteristics and behaviour, see Hernæs and Zhang (2005).

#### **Firm survey data**

In 2003 Statistics Norway conducted a survey (hereafter denoted ABU) of 2 358 firms with about 383 000 employees in the public and private sector in Norway. The sample was drawn from the population of firms with more than 10 employees, a total of 38 878 firms with 1 658 038 employees, covering around 2/3 of the labour force. An array of questions was answered by the manager of each firm, of which we use answers on pension plan, training, unionisation and wage negotiations. Data on employees from the register data described above were linked to the survey, creating a very rich data set on workplaces and employees. Among the private sector firms, we used 494 firms which reported to have a defined benefit

(DB) pension plan and 446 firms which reported not to have any pension plan, with a total of 119 000 employees.<sup>13</sup>

## **4. Pension cost and tax gains**

### **The cost of a DB plan**

Based on detailed information on companies and their employees from register and survey data, we applied the procedures used by actuaries for calculating liabilities to reconstruct the costs actually incurred by firms. For this paper, we have calculated the cost of a 66 per cent pension plan in the year 2001, given the labour force in each firm. As a measure of cost we have used the annual increase in the present value of entitlements (SCC). The only information we lack is tenure, so we have assumed that all employees have vesting in the firm from an early age, which has no great impact on the cost calculation, see Hernæs and Zhang (2005).

### **Tax gain**

We focus on firm behaviour, and therefore we develop a measure of the tax gain from an occupational pension compared to a cash wage increase, calculated for all employees. The tax gain is defined as the difference in the after tax present values of two alternative compensations which are identical for the firm. One alternative is a 66 per cent occupational pension and the other alternative is the same total compensation from the firm, given as

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<sup>13</sup> 409 firms reporting a defined contribution (DC) pension plan were omitted from the analysis, since DC was legislated only from 2001 and we believe these firms either misunderstood the question or operated a DC plan for a minority of employees. Summary data from the insurance companies show that 97 % of total contributions were to DB plans in 2003.

proportional wage increases for all employees in the firm. Details can be found in Hernæs and Zhang (2005).<sup>14</sup>

The tax gain can be shared between the firm and the employees. We do not treat this sharing explicitly, but view the tax gain as an incentive to offer an occupational plan. The starting point is the same as in Poterba (2004), to compare wealth which accumulates without tax on interest but is taxed on withdrawal, with wealth where the interest is taxed but withdrawal is not. We apply this idea to pension accumulation and improve it in two important ways. First, using the linked data on employees and firms, we use the same actuarial formulas which the firms do, and obtain the exact contribution required by a 66 % OP for each employee. Secondly, we apply actual tax rates which apply in the income bracket of the employee, both on pension (tax free accumulation; tax on withdrawal) and on an alternative wage increase (tax on receipt and on interest; not on “withdrawal”). Our results are therefore close to the actual gains.<sup>15</sup>

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<sup>14</sup> The gain,  $G_{ia}$ , for employee  $i$  aged  $a$  is the following difference:

$$\begin{aligned}
 G_{ia} &= C_i (1 - \tau_i^P) \sum_{t=a}^{R-1} (1+r)^{a-t} \\
 &- W_i \frac{C}{W} (1 - \tau_i^W) \sum_{t=a}^{R-1} \frac{(1 + (1 - \tau^r)r)^{R-t}}{(1+r)^{R-a}} \\
 &- v_i W_i \frac{C}{W} (1 - \tau_i^P) \sum_{t=R}^D (1+r)^{a-t} \\
 W &= \sum_{i=1}^N W_i \quad C = \sum_{i=1}^N C_i
 \end{aligned}$$

where  $C_i$  is the individual pension contribution,  $W_i$  is the individual (alternative) cash wage increase,  $\tau_i^P$  is the tax on pension and  $\tau_i^W$  the tax on earnings, both individual specific because of the progressive tax,  $\tau^r$  is the flat tax on interest on savings,  $r$  is the interest and discount rate,  $R-a$  is the remaining expected period of future work,  $D$  is the expected time of death,  $N$  are total number of workers in the firm and  $v_i$  is the individual specific NIS pension accrual. The marginal tax rates are used because the alternative compensations both are in marginal terms. One alternative is pension added to the NIS pension, and the other is a wage increase.

<sup>15</sup> Longevity is assumed to be the same. In case of death, there will be a bequest from the wage increase and survivor benefit from an OP.

We assume the rate of return and the discount rate both equal to 4 %. The tax gain is then driven by differences in taxes on the wage increase and on the corresponding pension, and the tax on interest. At the firm level, the tax gain is driven by the age and wage distribution of the employees. The relevant tax rates are given in Table 1.

*Table 1.* Marginal tax rates of income above the tax limitation limit and below 12 G for retirees and employees in 2001

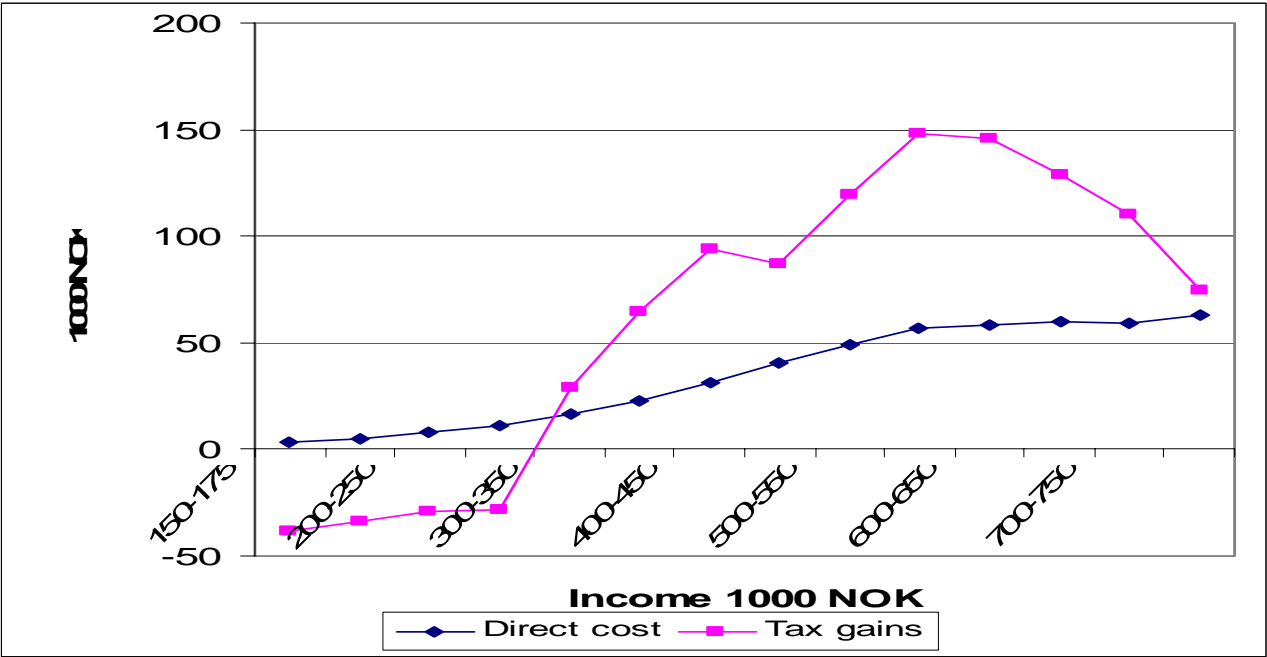
Income category	Tax rate
Wage	$\tau^W = \begin{cases} 0.358 \text{ for } W \leq 289000 \\ 0.493 \text{ for } 289000 < W \leq 793200 \\ 0.553 \text{ for } W > 793200 \end{cases}$
Pension	$\tau^P = \begin{cases} 0.31 \text{ for } P \leq 289000 \\ 0.445 \text{ for } 289000 < P \leq 793200 \\ 0.505 \text{ for } P > 793200 \end{cases}$
Interest	$\tau^r = 0.28$
NIS increase	$\nu = \begin{cases} 0.42 \text{ for } W \leq 303618 \\ 0.14 \text{ for } W > 303618 \end{cases}$

As can be seen from Table 1, the tax rates and brackets imply substantial tax wedges, since the pension will be considerably below the wage level. For example, with a 70 per cent replacement and wages of 300 000 NOK, the pension will be 210 000 NOK. In 2001, the marginal tax on an occupational pension at this level was 31 %, whereas the marginal tax on wage at the corresponding level was 49.3%. In addition, interest on savings will be taxed at 28 %.

With the assumption of a proportional potential wage increase as a comparator, we can then calculate gains for individual workers, reported by wage groups in Figure 1. The gain is calculated as the present value of the OP pension, minus the present value of the wage increase and the ensuing increase in the NIS pension, all taxed at their relevant level by individual income, with individual age also taken into account. Details can be found in Hernæs and Zhang (2005).

The gain is highest for high earners because they receive a pension contribution which cancels out the flatness of the NIS. This is particularly important above a wage level of 6 G (about 325 000 NOK), where NIS accrual falls from 42 % (see details in chapter 2) to 14 %. The gap filled by a 66 per cent OP therefore increases from 24 (66 minus 42) to 52 per cent. The fall in tax gain from the 450 000 – 500 000 bracket is caused by the increase in marginal tax on pensions accruing at this wage level, from 31 to 44.5 per cent.

Figure 1. Direct annual cost of a 66 % DB OP and the present value of the tax gain from this OP compared to the same amount from the firm in the form a firm-wide proportional wage increase



## 5. Model specification

### The firm’s decision framework

The decision on whether to provide an occupational pension<sup>16</sup> is formally made by the firm, although it may in fact be negotiated with unions or employees directly. In this context,

<sup>16</sup> We only consider DB since this was what was legislated in the observation period and we assume a replacement rate of 66 %, which is close to the average and the most typical replacement offered.

unions may serve as mediators and “honest brokers” for the employees, and thereby be important for an occupational pension to be implemented (Freeman, 1981). Motivated by the literature surveyed above, we assume that firms make this decision, which implies considerable cost, with a view to productivity gains and wage moderations and that these considerations motivate the arrangement.<sup>17</sup> Hence, we think of the firm as choosing between discrete alternatives, each represented by a “bundle” of attributes, which is distinct not only in the pension plan and its direct cost, but also in productivity and wage moderation. As will also be discussed, this framework implies that we need to have information on these attributes for all alternatives. The challenges and our solutions are given below.

### **Productivity effect**

Because of vesting time and imperfect portability, compensation in the form of an occupational pension is a form of deferred payment. Therefore it tends to reduce turnover among incumbents (Even and Macpherson, 1996 and Ippolito, 1991) and it may also attract more “stable” workers. This may reduce training costs and increase human capital and productivity in the firm.<sup>18</sup> Cornwell and Dorsey (2000) provide evidence of what they term a “defined benefit-defined contribution premium”, and find the strongest effect in large manufacturing firms. This is more important the more extensive training the firm requires. Because it rewards employees who stay at the company, it is also an additional reward for revealed productivity and tenure. Hence, it may be less efficient in small companies, where productivity is more easily observed and rewarded. On the other hand, Papke (1999) finds that at the plan sponsor level, which is the focus of our study, many 401(k) plans in the US have

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<sup>17</sup> Support for this approach can also be found in anecdotal from both for the US and Norway. In Norway, the public debate on the reform of the NIS has increased the public awareness of occupational pensions, and interviews in a newspaper (Verdens Gang, 11 March 2003) with managers and employees of two firms show that employers may view an occupational pensions as a recruitment instrument, and that there exist agreements on wage moderation to pay for an occupational pension. For the US BusinessWeek online report marketing of pensions with similar arguments

<sup>18</sup> Dorsey (1995) provides a review of the literature. Mitchell (2000) covers more recent developments.

substituted for DB plans. After legislation in 2001 of DC plans, the same trend is observed in Norway, and it would be interesting to explore further whether this substitution is concentrated in certain sectors.

### **Savings efficiency, tax gains and wage-pension trade off**

An occupational pension may serve as an efficient way of saving for retirement for the employees. First, the firm may have large scale efficiency in setting up pension arrangements. Second, there is a tax gain for the firm and the employees to share as described in chapter 4. A savings efficiency or tax generated gain can be shared by the employer and the employees by cash wage moderation. In the present version, we have not attempted to model this split. A direct wage-pension offset is not (directly) observed. A cross-section regression of wage on pension and a lot of controls, gives a large positive coefficient for pension, as is also found in much of the literature. Dorsey (1995) provides a survey up to that time. This indicates that if there is trade off, this is masked by unobserved heterogeneity and/or endogeneity bias, since a pension may at the same time attract productive employees (who will have a high (total) compensation). If productivity is imperfectly observed, then it becomes very difficult to identify the two effects. By comparing groups of municipal employees, Ehrenberg (1980) finds a (partly) compensating wage effect from lower employer contributions to the pension, but with a fairly limited data set. A study by Gunderson *et al.* (1992) is based on linked collective agreements and pension plan, giving firm level data. They find indications of a trade off between pension and wage, but the results are generally not very strong and sensitive to specifications. A recent study (Andrietti, 2004) finds a positive substitution by instrumenting the pension, but is lacking information on type and generosity of the pensions. In the present study, we measure the tax driven tax gain which can be shared between firm and employees and study the association with the occurrence of an OP. Both direct cost and wage moderation are left out, implicitly assuming wage moderation at least cancel out the



direct cost. Wage moderation in excess of direct cost is the way firm and employees share the tax gain.

## **The role of wage negotiations and unions**

Whether the direct cost of an occupational pension is compensated by a lower wage level, depends also on how the wages are determined. In Norway wages are set in several stages. There are central or union-wide agreements, and these set the standard for all employees in the company if some are unionised. In addition there are negotiations at the company level, involving unions and allowing individual wage negotiations. If a company views an OP as a way of reducing wage claims, it seems reasonable that this might only be relevant for the part of wage increases which are locally negotiated, whether by unions or at an individual level. On the other hand, the presence of a union might be an accommodating factor, serving as a communication channel between firm and employees (Freeman, 1981).

In an early study distinguishing between union and non-union firms, Mitchell and Luzadis (1988), using US data covering the period 1960-1980, found that while the incentives offered by non-union plans were quite static over this period, all encouraging later retirement, the union plans changed, moving to an encouragement of early retirement by 1980. In the present context, this does suggest that union interest in pension plans may reach beyond worker entitlement.

## **The empirical model**

### **The firm's choice**

Here we will focus on the choice between offering a pension plan with replacement level equal to 66 % or not offering a pension plan at all, corresponding to  $p = \{1, 0\}$ . Let  $y_{jp}$  be the profit increment in firm  $j$  related to offering an OP plan  $p$ , let  $v_{jp}$  be the

deterministic part and  $\varepsilon_{jp}$  the random part. The latter captures unobserved factors affecting increments in profit.

Firm  $j$  selects a pension plan  $p$  that maximises:

$$y_{jp} = v_{jp} + \varepsilon_{jp} \quad p = 0,1$$

with the error terms  $\varepsilon_{jp}$  being iid extreme value distributed.

Tenure for employee  $i$  in firm  $j$  denoted  $T_{ij}$ , is observed for each firm only as a result of the firm's choice of offering or not offering an occupational pension. In the model we need also potential tenure for the alternative for each firm. This is modelled below.

Direct cost  $SCC_{jp}$  is used to construct the tax gains  $GAIN_{jp}$ . Both variables are defined in Section 4. Without observing how these are shared between the firm and the employees, we assume that the average gain over all employees in the firm motivates an OP, and introduces it in the choice equation.

The estimation implicitly assumes that companies can switch a pension plan on and off, or that current condition is representative for long-term consideration. The first is obviously not the case, which leaves the interpretation that benefits and costs for a company in the year observed were the same when the decision on OP was taken, and that it was then assumed by the company to continue into the future.

The alternative we have chosen is to assume that the firm relies on the expected value of tenure. We can then model tenure on other variables which are observable both for firms with and without an occupational pension, and use predictions from this model. This will also address the problem that a firm does not know exactly the turnover it will have with or without an occupational pension, but will have expectations. For this line of reasoning to hold, we have to model all that is known to the firm. If there are components which are

known to the firm but not to us, these will enter into the error term, and we will not be able to impute the “real” expectations of the firm.

If we capture the expectations of the firm, ordinary logit estimation can be carried out. With the error terms extreme value distributed of type I and  $v_{ij}$  uncorrelated with  $\varepsilon_{ij}$ , we obtain the probability of the firm  $j$  choosing an OP (since we have only two alternatives, we can drop the subscript denoting alternative in the choice expression so that  $v_j = v_{j1} - v_{j0}$ ):

$$(1) \quad P[y_{j1} \geq y_{j0}] = \frac{\exp(v_j)}{1 + \exp(v_j)}$$

Here, the structural part  $v_j$  is

$$\begin{aligned} v_j = & \xi_0 + \xi_1 \text{TENUREGAIN}_j + \xi_2 \text{TAXGAIN}_j \\ & + \xi_3 \text{FIRMSIZE}_j + \xi_4 \text{UNION}_j + \xi_5 \text{NEGOTIATIONS}_j \\ & + \xi_6 \text{TRAINING}_i + \xi_7 \text{INDUSTRY}_j \end{aligned}$$

in which

$\text{TENUREGAIN}_j$  is the average firm specific tenure over employees of firm  $j$  up to year 2001 given pensions plan  $p$ . It is estimated on employment register data for each employee reporting starting year in the firm, see below.

$\text{TAXGAIN}_j$  is the sum of tax gains in present values, for all employees in firm  $j$  given pension plan  $p$ , compared to a wage increase equivalent to the firm, as described above. This tax gain is calculated for each employee and averaged across employees for each firm. It will vary across firms for the same alternative, due to cross firm variation in the wage and age structure.

$\text{FIRMSIZE}_j$  is the number of employees in firm  $j$ , grouped as follows: Small (-25), Medium (26-200, reference group) and Large (201-). For a large firm, monitoring costs may be higher and the advantages of a deferred payment larger.

$UNION_j$  is the fraction of employees in firm  $j$  who are members of a union.

$NEGOTIATIONS_j$ . The firm is asked about negotiations in the annual wage settlements: Only individual (reference group), only central, only local or both central and local negotiations in firm  $j$ .

$TRAINING_j$  is the reported required training period for a new employee of the main occupational group in firm  $j$ . We expect the longer the training period, the higher is the training cost of recruitment and the more willing is the firm to offer an occupational pension which is expected to increase the length of the relationship between the employee and the firm.

$INDUSTRY_j$  is a vector of dummy variables for industry at one-digit level.

### **The workers' choice of having a lasting relationship with the firm (tenure)**

The corollary of our hypothesis that firms use an OP to attract and retain employees, is that employees on average stay longer in firms with an OP, *cet. par.* Although some employees may not prefer an OP, because of variation in preference and also because the pension contribution and wage moderation may have different profiles, we expect that average tenure among employees in a firm increases with an OP in the firm. Furthermore, tenure is obviously influenced by many other factors, and there may also be interaction between the occurrence of an OP and other variables. Therefore we estimate separate tenure regressions with a lot of controls, for firms with and without OP. We then use the two estimated regressions to predict tenure with and without an OP, for all firms. The interpretation is that an OP in a non-OP firm will influence tenure of all groups of employees, by changing their tenure regressions coefficients to those of OP-firms. Similarly, non-occurrence of OP in an OP firm is assumed to change the tenure coefficients to those of non-

OP firms. The difference, denoted  $TE\hat{N}UREGAIN_j$  below, is interpreted as the impact of an OP on tenure and is entered into a logit equation of the firm's choice of an OP.

The following reduced form tenure regression is estimated separately on firms with and firms without an OP:

$$(2) \quad T_{ij}^k = \alpha_0^k + \alpha_1^k AGE_{ij}^k + \alpha_2^k MALE_{ij}^k + \alpha_3^k EDUC_{ij}^k + \alpha_4^k FIRMAGE_{ij}^k + \mu_{ij}^k; \quad k = 1, 0$$

in which

$T_{ij}$  is the tenure (years) of employee  $i$  in firm  $j$

$AGE_{ij}$  is the age group (see Table 2) of employee  $i$  working in firm  $j$

$MALE_{ij}$  equals 1 if the employee  $i$  is male, working in firm  $j$

$EDUC_{ij}$  is the education group (see Table 2) of employee  $i$  in firm  $j$

$FIRMAGE_{ij}$  is the age in years of the firm  $j$  in which employee  $i$  works, calculated to year 2001 from the reported starting year in the survey and

$k = 1, 0$  denotes firms with and without an OP

For each firm we then predict average tenure with and without an OP and calculate the difference, interpreted as the gain (realized or potential of having an OP):

$$TE\hat{N}URE_{j1} = \frac{1}{N_j} \sum_{i=1}^{N_j} \left[ \hat{\alpha}_0^1 + \hat{\alpha}_1^1 AGE_{ij} + \hat{\alpha}_2^1 MALE_{ij} + \hat{\alpha}_3^1 EDUC_{ij} + \hat{\alpha}_4^1 FIRMAGE_{ij} \right]$$

$$TE\hat{N}URE_{j0} = \frac{1}{N_j} \sum_{i=1}^{N_j} \left[ \hat{\alpha}_0^0 + \hat{\alpha}_1^0 AGE_{ij} + \hat{\alpha}_2^0 MALE_{ij} + \hat{\alpha}_3^0 EDUC_{ij} + \hat{\alpha}_4^0 FIRMAGE_{ij} \right]$$

where  $\hat{\alpha}_s^k$ ;  $s = 1, 2, 3, 4$ ;  $k = 1, 0$  are estimated coefficients.

$$TE\hat{N}UREGAIN_j = TE\hat{N}URE_{j1} - TE\hat{N}URE_{j0}$$

$TENUREGAIN_j$  that appears in the logit probability (1) may be considered as the expectation firm  $j$  has with respect to the increase in average tenure with and OP, compared to not having an OP. Since the estimates of the coefficients and therefore  $TENUREGAIN_j$  are assumed to depend on the presence of an OP in the firm and the decision by the firm depends on the impact on tenure, an endogeneity problem may arise when the logit probability in (1) is estimated with  $TENUREGAIN_j$  as one covariate. To account for this directly when estimating the model is not straightforward and we have decided to estimate the logit probability in (1) with and without  $TENUREGAIN_j$  in the logit probability. The results are reported in Appendix 1. If the estimates of the parameters in (1), other than the one attached to  $TENUREGAIN_j$ , are about the same whether  $TENUREGAIN_j$  is included or not, we conclude that the endogeneity problem is not important. We also observe that there are more variables than  $D_{ij}$  that affects  $TENUREGAIN_j$ .

Summary statistics are given in Appendix 2.

## 6. Estimation results

We first estimate ordinary least squares regressions of firm tenure on all employees in the ABU firms using equations (2), separately for firms with and without an OP. The results are shown in Table 2, with age, gender, education and age of the firm as controls.

Table 2. Estimates of tenure in years,  $T_{ij}^k$

Variables	Firms with an OP (k=1, 94445 observations, $R^2 = 0.27$ )		Firms without an OP (k=0, 23394 observations $R^2 = 0.26$ )	
	Estimates	t-values	Estimates	t-values
Age, [<26]	-5.8140	-81.72	-4.4286	-43.82
Age, [26,35]	-3.3846	-60.66	-2.3870	-25.93
Age[46,55]	3.0724	52.89	2.0574	19.18
Age[>55]	4.9292	68.48	3.6161	25.73
Male	1.6193	35.47	1.2313	16.50

Educ [<10years]	1.0988	11.15	0.7362	5.00
Educ [>12 years]	-0.1175	-2.62	0.3338	4.82
Company age in years	0.0172	39.87	0.0345	32.62
Constant	4.8390	77.95	3.2148	31.54

We observe that in both regressions, tenure increases with the age of the employee as well as with the age of the firm. Males have about 1.5 years longer relationship with the firms. Tenure is estimated to decline with education level in OP firms, but to be a U shaped function in the non-OP firms.

To illustrate the impact on tenure, Table 3 and Figure 2 show the average of predicted tenure using both regressions for OP firms and non-OP firms.

*Table 3. Predicted tenure*

	Average predicted tenure using coefficients estimated on OP firms	Average predicted tenure using coefficients estimated on non-OP firms	Average TENUREGAIN (column 2 minus column 3)
Firms with an OP	6.64	5.88	0.76
Firms without an OP	5.34	4.50	0.84

From Table 3 we note that in line with the results of Ippolito (1991), the occurrence of an OP increases tenure by a little less than a year around a mean of 5-6 years. However, the predicted gain is somewhat smaller among firms that have actually chosen to have an OP, than among firms that have chosen not to have an OP. As will be seen below, this causes the coefficient on TENUREGAIN not to be significant in the firms' choice equation discussed below.

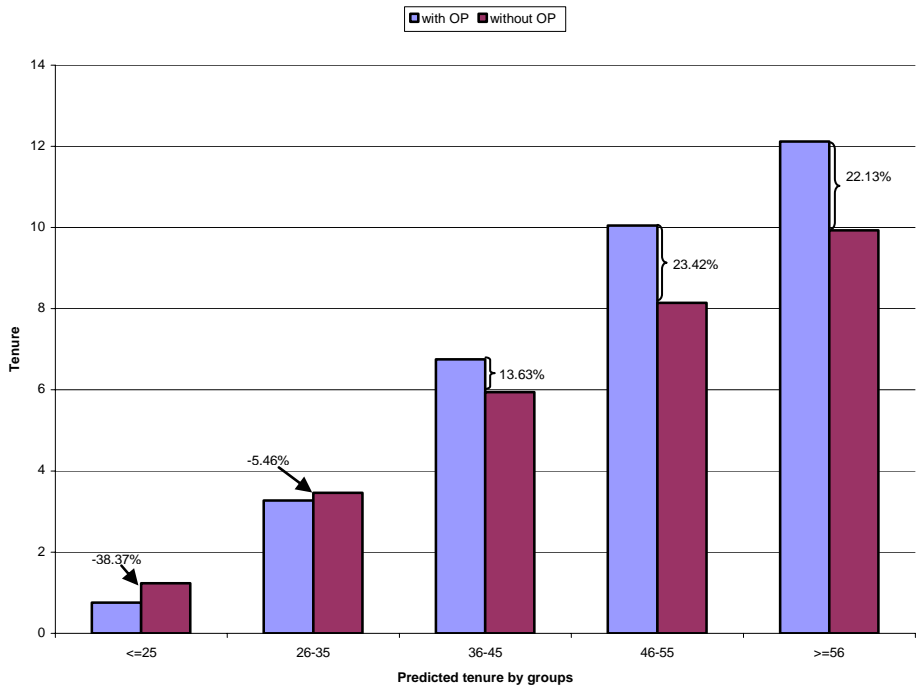
Still we note the distinct difference in tenure between OP firms and non-OP firms. The average tenure in OP firms is on average 2.14 years or almost 50 % longer than in non-OP firms. In a tenure regression decomposition described in Table 3<sup>19</sup>, about 0.8 years of this difference is driven by coefficients and the rest by difference in labour force composition in

<sup>19</sup> Individual linear tenure regressions in firms with and in firms without OP, used to predict counterfactual tenure.

the two groups of firms. It is still possible that the longer tenure in OP firms is in part caused by the OP, and we could hypothesize that also the composition of the labour force could change in response to presence of non-presence of an OP. However, we have so far no measure of this potential gain<sup>20</sup> and leave this to further research.

From Figure 2 we note that young people are predicted to have shorter tenure in OP firms than in non-OP firms, while the opposite holds for older people. This probably means that people tend to stay longer in OP firms, but also that OP firms are not the first firms young people enter into. Therefore young people observed in OP firms have worked there for a shorter period than young people in non-OP firms, which tend to be their first firm. For older people, the tendency to stay longer dominates. This shows the importance of controlling for many factors in the tenure regressions.

Figure 2. Predicted tenure by age groups with estimates from OP and from non-OP firms



<sup>20</sup> For a firm choice model to give a positive coefficient on gain, the potential gain would have to be larger for firms that have actually chosen an OP.



From estimates of the coefficients in a logit equation on the firm's choice of OP, reported in Table 4, we observe a number of significant and strong determinants of firms offering an occupational pension. The average gain of employees has a very strong effect on the firm's probability of offering an occupational pension. Evaluated around the baseline firm in Table 5 (around 34 % probability of an occupational pension), one standard deviation increase in the gain will increase the probability by around 17 percentage points. This is compatible with an interpretation that the firm keeps at least part of the gain from an occupational pension versus higher wage, which implies that there is wage moderation in excess of the direct cost to the firm on an OP. Because the gain is strongly increasing in wage level relative to the NIS, the gain effect is compatible with the high occurrence of occupational pensions in high wage firms. To our knowledge, such results are not found in any previous study.

A further indication that wage moderation may play a role and motivate further research into this aspect is the clear effect of negotiations. Central negotiations imply about 4 percentage points lower probability of an occupational pension compared to only individual negotiations (reference group). In the same vein, one standard deviation increase in the proportion unionised increases the probability by 20 percentage points. This fits in well with the results and arguments of Freeman (1981), who concludes that the unions are vehicles for accommodating an agreement on a pension. It also supports the hypothesis that individual negotiations are necessary to allow wage moderation in return for an occupational pension. Along the same lines are the results of Leigh (1981) that unions will increase knowledge about pensions. This will increase their efficiency as a tool for the firm, and therefore increase their probability of offering occupational pensions.

The results confirm that occupational pension plans are a large firm phenomenon, even after controlling for many other variables. There are a number of reasons for this, as referred to in several of the studies described earlier in the paper. First, there can be large scale benefits for large firms in setting up occupational pensions. However, the cost side is taken care of in the gain calculations, which build on detailed cost calculations, where size is a factor. Secondly, an occupational pension may more attractive in a large firm, since a large firm may more provide job opportunities and thereby increase the expected (by the employee) length of employment in the firm and thereby reduce the expected pension separation loss.

Finally, training requirements clearly increase the probability of an occupational pension. This is quite reasonable, since firms which require long training of their workforce<sup>21</sup> will have strong motivation to operate an occupational pension and keep their workers.

As discussed above, the question of potential gain in tenure as a motivation is not resolved in the present study, although we note about 50 % longer average tenure in firms with an OP, after controlling for a number of characteristics of the labour force.

*Table 4.* Estimates of the firms' choice probability of offering occupational pension

Variables	Estimates	t-values
Firmtenure	-0.1557	-1.26
Firmgain	0.0319	6.51
<i>Firmsize</i> <sup>1</sup> :		
Small (10-25 employees)	-1.1703	-4.88
Large (More than 200 employees)	1.4898	6.17
<i>Wage negotiations</i> <sup>2</sup> :		
Only central	-1.9279	-5.41
Only local	-0.9949	-2.67
Both central and local	-0.8576	-2.91
Unionization in percentages	2.5484	7.1
<i>Training</i> <sup>3</sup> :		
Up to 1 month	0.7657	2.04
Up to 6 months	1.1750	3.22
More than 6 months	1.2310	3.20

<sup>21</sup> Training requirement is for the main occupational group of the firm

Industry dummies		YES
Constant	-2.4102	-5.08

1) Reference group is mid-size: 25-200 employees 2) Reference group is only individual wage 3)Reference group is 1 week or less

McFadden's rho= 0.4820, Number of observations=875

The impact of the tax gain can be illustrated by the aggregate elasticity of the OP choice probability of the firms with respect to the gain:  $EL_{Z_j} = (1 - \hat{\phi}_j) \hat{\beta}_Z Z_j$ , where  $\hat{\phi}_j$  is the predicted probability for OP, which follows from the estimates given in Table 4,  $\hat{\beta}_Z$  is the estimated coefficient and  $Z_j$  is the gain covariate. We note that the elasticity vary across firms. The mean in the population of these firm-specific elasticities is 0.21 and the standard deviation is 0.37. Thus there is a large variation across firms. The magnitude of the effects is illustrated in Table 5, which report average of predicted OP probabilities with various combinations of covariates.

Table 5. Predicted firm choice probabilities of offering an occupational pension

Covariate values	Predicted probability of offering occupational pension
<i>Mean prediction</i>	0.5086
<i>Baseline:</i> Medium sized firm, individual wage negotiations, required training up to 1 week, manufacturing industry, sample average firm tenure, sample average firm gain, and sample average degree of unionisation	0.3389
<i>Partial variation:</i>	
Large firm	0.4272
Only central wage negotiations	0.2906
Required training up to 6 months	0.4500
Firm gain one standard deviation above average	0.5166
Unionization one standard deviation above average	0.5761
Financial industry	0.3829

We note that the difference between a large and a medium sized firm in the probability of an OP, is approximately same as the difference between training requirements up to 6 months compared to less than one week, and less than a tax gain one standard deviation above average. The industry effects (not shown in Table 4) are also considerable, as illustrated by the one included in Table 5.

In Appendix 1 we report the estimates of the firms' choice probability of offering an occupational pension when FIRMTENURE is excluded as an explanatory variable. By comparing the results there with the estimates in Table 2 we observe that nothing much happen to the other estimates. The only, but minor, difference is that individual negotiations become more important. We take this as indication that the endogeneity problem is not that important. Additional regressions also showed that the impact of gains remained significant also when entered alone, and that the other estimates were largely unchanged. Hence, our results appear robust to some of the tenure specification, but with the modification that we fail to identify the motivating effect directly.

## 7. Conclusions

We have constructed a unique linked employer-employee dataset, and supplemented this with detailed actuarial calculations of the cost to the firms of offering occupational pensions, and tax gains from pension contributions versus cash wage. We find that the constructed tax gains are clearly associated with the occurrence of an occupational pension plan, indicating that there may be a joint gain for employers and employees. For the employers the gain is wage moderation and for employees the gain is related to the fact that pensions are taxed at lower rates than wage income. In further work we plan to study this further and look at wage moderation and the way the tax gains are split between employer and employees.

Moreover, we find that occupational pensions typically are found in large firms, and that individual wage negotiations and requirement of long training are positively associated with an occupational pension. We also find that a high degree of unionization increases the probability of an OP.

Average tenure is more than two years longer in firms which has an OP, after controlling for a number of characteristics of the labour force of the firms. Most of the difference is due to differences in labour force composition, leaving somewhat less than one years difference after controlling for this.

We conclude that financial and productivity incentives for an OP are found to operate within a moderating institutional framework.

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## Appendix

*Table A1.* Estimates of the firms' choice probability of offering an occupational pension when FIRMTENURE is excluded as an explanatory variable.

Variables	Estimates	t-values
FIRMGAIN	0.0315	0.0049
<i>Firmsize 1).</i>		
Small	-1.1900	0.2393
Large	1.5116	0.2404
NEGOTIATIONS <sup>2</sup> :		
CENTRAL	-1.8943	0.3540
LOCAL	-1.0095	0.3718
CENTRAL/LOCAL	-0.8511	0.2938
UNION COVERAGE	2.5013	0.3311
TRAINING:		
1 MONTH	0.8016	0.3756
6 MONTHS	1.2200	0.3643
12 MONTHS	1.2756	0.3838
INDUSTRY DUMMIES	YES	
FIXED EFFECTS	YES	

1) Reference group is MIDDLE, 2) Reference group is INDIVIDUAL

McFadden's rho= 0.3361, Number of observations=875

*Table A2.* Summary statistics for the tenure regression

Variables	Mean	Std	Min	Max
<i>OP firms</i>				
Mean Tenure	6.6383	7.2754	0	50
Male	0.7284	0.4448	0	1
Age (.,25]	0.1153	0.3194	0	1
Age [26, 35]	0.2591	0.4382	0	1
Age [36,45] (ref)	0.2681	0.4430	0	1
Age [46, 55]	0.2328	0.4226	0	1
Age [56, .)	0.1246	0.3303	0	1
Company age (yrs)	49.6967	46.9323	0	234
Educ, <=9 years	0.0530	0.2241	0	1
Educ, [10-12] years (ref)	0.2788	0.4484	0	1
Educ, >= 13 years	0.6363	0.4811	0	1
<i>Non OP firms</i>				
Mean Tenure	4.5016	5.9255	0	47
Male	0.3070	0.4613	0	1
Age (.,25]	0.2247	0.4174	0	1
Age [26, 35]	4.5016	5.9255	0	1
Age [36,45] (ref)	0.1778	0.3824	0	47
Age [46, 55]	0.0856	0.2797	0	1
Age [56, .)	32.9587	31.3707	0	1
Company age (yrs)	0.0675	0.2509	0	183
Educ, <=9 years	0.3876	0.4872	0	1



Educ, [10-12] years (ref)	4.5016	5.9255	0	1
Educ, >= 13 years	0.4980	0.5000	0	1

*Table A3.* Summary statistics for logit regression

Variables	Mean	Std	Min	Max
Mean tenures within firms	5.5709	3.7655	0	24.3333
Mean gain with 66% replacement ratio (1000 NOK)	19.9824	23.0823	-159.46	122.8458
Agriculture	0.0137	0.1164	0	1
Production	0.3257	0.4689	0	1
Construction	0.0354	0.1850	0	1
Energy	0.0766	0.2661	0	1
Trade	0.2411	0.4280	0	1
Transport	0.0606	0.2387	0	1
Finance	0.1817	0.3858	0	1
Other	0.0651	0.2469	0	1
Small company, <=25 employees	0.2411	0.4280	0	1
Medium company, 26-200 employees	0.5086	0.5002	0	1
Large company, >= 201 employees	0.2491	0.4328	0	1
Unionization degree	0.4856	0.3837	0	1
Only central wage negotiation	0.1783	0.3830	0	1
Only local wage negotiation	0.0937	0.2916	0	1
Both central and local negotiation	0.5154	0.5000	0	1
Individual negotiation	0.2046	0.4036	0	1
require training up to 1 week	0.0686	0.2529	0	1
require training up to 1 month	0.2617	0.4398	0	1
require training up to 6 month	0.3909	0.4882	0	1
require training up to 1 year	0.2640	0.4411	0	1