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ELINKEINOELÄMÄN TUTKIMUSLAITOS
THE RESEARCH INSTITUTE OF THE FINNISH ECONOMY
Lönnrotinkatu 4 B 00120 Helsinki Finland Tel. 358-9-609 900
Telefax 358-9-601 753 World Wide Web: http://www.etla.fi/

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Hannu Piekkola* – Antti Kauhanen*

RENT SHARING AS PART OF INCENTIVE PAYMENTS AND RECRUITMENT**

* The Research Institute of the Finnish Economy – Lönnrotinkatu 4B, FIN-00120 Helsinki, Finland. Tel: (+) 358-9-609 90 246, Fax: (+) 358-9-601 753, e-mail: Hannu.Piekkola@etla.fi, Antti.Kauhanen@etla.fi

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ABSTRACT: The aim of this paper is to examine rent sharing under a heterogeneous workforce using linked employer-employee Finnish data in 1987-1998 located in Statistics Finland. It is shown that rent sharing moderates firm-level wages and that the highly educated workers are the main targets. In non-R&D-intensive firms, flexible labour supply encourages the use of rent sharing. Rent sharing is effectively used to hire new workers or to lower unwanted job mobility. However, rent sharing is more common in R&D-intensive firms. In R&D intensive firms rent sharing is more explained by human capital accumulation and targeted at experienced workers. Flexible technology in the R&D intensive firms also leads to the substitution of rent sharing for monitoring costs.

Keywords: wage differentials, labour management, linked employer-employee data

JEL Classification numbers: J32, J31, J53, C23

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TIIVISTELMÄ: Tutkimus tarkastelee eri koulutusryhmien voitonjakoa Tilastokeskuksen yhdistetyllä työntekijä- ja yritysaineistolla vuosilta 1987-1998. Tutkimuksen mukaan yritykset korvaavat tulospalkkauksella muuta palkkausta. Tulospalkkaa saavat erityisesti hyvinkoulutetut. Yrityksissä, joilla tutkimus- ja tuotekehitysmenot ovat vähäiset, tulospalkkaus on yleistä etenkin silloin, kun työvoiman liikkuvuus työpaikasta toiseen on suurta. Siten tulospalkkauksella voidaan lisätä työntekijöiden pysyvyyttä yrityksessä. Tulospalkkaus on kuitenkin yleisintä yrityksissä, jotka harjoittavat tutkimus- ja tuotekehitystä. Näissä yrityksissä tulospalkkaa saavat etenkin koulutetut ja kokeneet työntekijät. Tuotantomenetelmät ovat joustavia ja tulospalkkauksella korvataan suoritepalkkausta.

Asiasanat: palkkausjärjestelmät, työvoiman kysyntä, yhdistetty työntekijä-yritysaineisto

JEL Classification numbers: J32, J31, J53, C23

1. Introduction

This paper considers rent sharing and applies the model to the Finnish labour market in 1987-1998 using linked employer-employee data. The rent sharing model includes elements from trade union approaches (starting from Dunlop, 1944, and MacDonald and Solow, 1981), and is an extension of Koskela and Stenbacka (2001), where the firm generates random revenue distributed continuously conditional on the labour input. The Nash bargaining adapted from Koskela and Stenbacka (2001) is extended to have two types of workers: low skilled and high-skilled. Skilled workers with higher stochastic productivity receive a wage premium over the low skilled that depends on the profitability of the firm. The model, hence, allows us to analyse an optimal skill premium for high skilled together with optimal rent sharing. We keep the model simple and abstract from Solow-type efficiency wages that would imply a mark-up in the rent sharing (see Solow, 1979, Nickell, 1994).

Some earlier papers have found substantial rent sharing for all workers on average. Abowd and Allain (1996) show that, after proper instrumenting, French workers have considerable bargaining power; about 40 per cent of quasi rent is shared on average over all industries using export and import prices as instruments.[1] Piekkola (1999) adapts a similar fixed effects model that uses international prices as instruments and person fixed effect estimations for opportunity income assessment, following Abowd, Kramarz and Margolis (1999). Piekkola shows that instrumenting does not substantially change the rent sharing coefficient in Finnish manufacturing. Rent sharing is more modest at around 2 percent of quasi rent (see also Piekkola and Haaparanta, 1999). One indeed expects centralised bargaining in Finland to leave less room for firm-specific payments. Holmlund and Zetterberg (1991) show in country comparisons that the elasticity of firm (industry) wages with respect to firm (industry) revenue per employee is negatively related to the standard Calmfors and Driffill (1988) index of the centralisation of wage bargaining. The lowest industry estimation, around zero, is found for Finland. The low importance of rent sharing is not inconclusive, however, as the overall estimate of rent sharing is not significantly lower than the average 3 percent found in many other studies that do not use the instrumenting technique (see Blanchflower, Oswald and Sanfey, 1996, Hildreth and Oswald, 1997).

The ambiguous or highly varying results in the econometric estimates of quasi rent effects on wages can also result from the inability to separate firm-level compensations from other wage compensations that relate to the transferable human capital of the workers. The basic aim of rent splitting in our model is to moderate other firm-level payments, which is also supported by our results

Profit sharing in firms is also used to lower job turnover. The data in Azfar and Danninger (2001, Figure 1 on p. 624) supports the view that separations and quits are lower in profit sharing firms when tenure is 7 years or more. The job mobility of younger workers remains high. Azfar and Danninger (2001) suggest that profit sharing may have an adverse effect on quitting behaviour for risk averse workers in the short run and/or employers are reluctant to share rents. The reason is the expected shorter tenure of the employer, i.e. the limited amortisation period for firm-specific human

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1 The quasi rent effect is found to be substantially higher under the various forms of instruments used such as international trade prices, innovations or domestic demand shocks.

capital investments. Chelius and Smith (1990) also find evidence that workers whose compensation is partly in the form of profit sharing experience higher employment stability. However their results are only marginally significant. Kraft (1991) finds that profit sharing decreases the dismissals made by firms.

Our major finding is the variation in rent sharing and labour supply depending on the education level or labour market experience. Skilled workers with higher institution education enjoy double the higher rent splitting than the rest (in Piekkola, 1999, workers with university degree education have triple the rent splitting that others have). The importance of rent sharing for a skilled workforce is one reason why our sample also includes a higher proportion of the highly educated (employees with bachelor's degrees (lower university and non-university degrees) or higher). We also use estimated values of firm-level rent sharing that are compared with other firm-level wage compensations such as starting wages and seniority payments.[2] What is also important, given the relative low level of average rent sharing, is to separate positive rent sharing from situations where firm-level wages tend to decrease with the improved performance of the firm, as happens in nearly half of the firms.

Prime age workers are also somewhat more mobile than experienced workers at age 39-49 are and this may affect the results. Finally, R&D-intensive firms may rely more on long term employment relations, although firms are on the average young. Rent sharing is shown to be targeted at experienced workers. In R&D firms rent sharing may also depend more on transferable skills if these are complementary to firm-specific skills. This is left unexamined.[3]

Section 2 provides a rent-sharing model with unskilled and skilled workers and a job search model. Section 3 describes our data sources and methods. Section 4 discusses the results. Finally, we conclude in Section 5.

2 Starting wage also show fixed-term contracts. Fixed-term contracts are concentrated in small establishments with less than 20 employees (Dale and Bamford, 1988). In Finland, almost half of fixed-term contracts are made in small firms (Nätti and Väisänen, 2001).

3 Kessler and Lulfesmann (2000) argue that also incentive complementarity give rise to situations where returns from transferable human capital are also shared. The first reason is that high firm-specific training makes outside options non-binding. Another reason is that if the return from specific investment turns out to be low and an outside option becomes binding, the employer is compensated for this by being able to reap a full return from specific investment.

2. A Model of Rent Sharing

In this section we present a model characterised by heterogeneous workers and an uncertain environment. This section draws heavily on Koskela and Stenbacka (2001). Workers are separated by their ability. One is high skilled and the other is low skilled. The high skilled receives a skill premium r that is decided by the firm. The firm also uses profit sharing as a compensation instrument. The profit share τ determines the fraction of profits that the workers receive. The base wage that both workers receive is decided in a Nash bargain between the employer and an employees' union.

The decisions are made in sequence in this model. In the first stage the firm commits to profit sharing and skill premium. In other words it unilaterally chooses the profit share τ and the skill premium r. This is done on grounds of realism. In a centralised bargaining environment there is no evidence of bargaining over profit sharing. After the firm's decision on the variable parts of compensation the union and the firm engage in bargaining about the base wage. At the last stage the firm unilaterally optimises employment. Backward induction is applied as a solution strategy.

Stage 1	Stage 2	Stage 3
τ , r	w	N

The set-up of the model

The firms use two kinds of labour; high skilled and low skilled. They are defined $H = \delta N,\ L = (1-\delta)N$, respectively. So $N=H+L$. The parameter δ is assumed to be exogenously given, in order to simplify analysis. This model concentrates on the skill premium and profit share and their interactions, and this specification introduces the fact that the two kinds of labor considered here are not perfectly substitutable. This is highlighted in the empirical part in the way that the high skilled are considered to be the ones with higher level education.

The firm generates random revenue γ. The revenue is distributed continuously conditional on the labour input. The random revenue function is defined in equation (1).

$$f(\gamma \mid L,H) = \lambda_{\mathrm{L}}(L)\lambda_{\mathrm{H}}(H)e^{-\lambda_{\mathrm{L}}(L)\lambda_{\mathrm{H}}(H)\gamma} \qquad (1)$$

We make assumptions of the functional form of the stochastic productivity function, so that the model can be further analysed. The function is assumed to satisfy

$$\lambda_{\mathrm{L}}\lambda_{\mathrm{H}}(N) = \frac{\alpha_L\alpha_H}{L^{\alpha_L}H^{\alpha_H}} = \frac{\alpha_L\alpha_H}{((1-\delta)N)^{\alpha_L}(\delta N)^{\alpha_H}} \text{ where } \alpha_L < \alpha_H \text{ and } 0<\alpha_L+\alpha_H<1 \qquad (2)$$

Here, α_L is a parameter corresponding to the low-skilled worker and α_H is a parameter corresponding to the high skilled worker. The first of the parameter restrictions in (2) expresses the differences in productivity. The second restriction guarantees that the function is well defined with diminishing returns. It implies

$$\frac{\partial \lambda_L \lambda_H}{\partial N} = -(\alpha_L + \alpha_H) \frac{\alpha_L \alpha_H}{(1-\delta)^{\alpha_L} \delta^{\alpha_H} N^{(\alpha_L+\alpha_H)+1}} < 0$$
$$\frac{\partial \lambda_L \lambda_H}{\partial N \partial N} = (\alpha_L + \alpha_H)\big((\alpha_L + \alpha_H) + 1\big) \frac{\alpha_L \alpha_H}{(1-\delta)^{\alpha_L} \delta^{\alpha_H} N^{(\alpha_L+\alpha_H)+2}} > 0 \qquad (3)$$

so that the revenue function is an increasing function of labour but at a decelerating pace, in a stochastic sense. In other words, the rise in the quantity of labour shifts the conditional density function towards higher returns at a decreasing rate. The two kinds of labour exhibit complementarity in production.

The effective cost of labour to the firm is $(1\text{-}\delta)w + \delta(1+r)w = (1+r\delta)w = \Delta w = \tilde{w}$. This equation says that the low-skilled workers receive the base wage and the high-skilled workers receive the base wage plus the skill premium. The firm breaks even when $\hat{\gamma} = \tilde{w}N$, that is when the random revenue is equal to the effective labour cost of hiring N workers. The firm is assumed to go bankrupt, when $\gamma < \hat{\gamma}$.

The expected profit function is as follows:

$$E\pi(N) = \int_{\hat{\gamma}}^{\infty} (\gamma - \tilde{w}N) f(\gamma \mid N) d\gamma = \frac{e^{-\lambda_L \lambda_H (N)\hat{\gamma}}}{\lambda_L \lambda_H (N)} \qquad (4)$$

The second term in the expected profit function is obtained by integration by parts. The firm has to hire a workforce at a going rate in advance to enable production. This means that the generated random revenue determines whether or not the firm remains solvent. The probability of bankruptcy is given by $\int_0^{\hat{\gamma}} f(\gamma \mid L) d\gamma = F(\hat{\gamma})$. The complement probability $1 - F(\hat{\gamma})$ gives the probability of remaining solvent. This formulation captures limited liability in the sense that the firm is interested in the part of the distribution where it remains solvent. At the lower part of the distribution, financiers will take over the firm. The profit function is also an increasing and concave function of the quantity of labour.

Determination of employment

The game is solved in backward order, so the first stage is the determination of the firms' labour demand. At this stage the firm takes the base wage settled at the firm-union bargain as given, and is committed to profit sharing and skill premium.

The firm is a profit maximiser and thus the optimal labour demand is found by differentiating equation (4) in respect to *N*. In its optimisation decision the firm takes the composition of the workforce as given. The first order condition for labour implies

$$-\lambda_H \lambda_L{}'(N)\left[\lambda_H \lambda_L (N)\hat{\gamma} + 1\right] - \left[\lambda_H \lambda_L (N)\right]^2 \tilde{w} = 0 \qquad (5)$$

The second order sufficient condition for the maximum is guaranteed by the concavity of the profit function. Substituting (2) in (5) we can explicitly solve for *N* as a function of the effective wage rate. The solution is shown in appendix A. It yields

$$N^* = c^{\eta} \tilde{w}^{-\eta} \qquad , \qquad (6)$$

where $\eta = \frac{1}{1\text{-}\tilde{\alpha}}$, $\tilde{\alpha} = \alpha_L + \alpha_H$, is the negative of the elasticity of labour demand in respect to the effective wage and c is a constant.[4] Substituting the optimal labour demand in the expected profit function we get the indirect profit function, given in equation (7). The optimality of the labour demand implies that $E\pi *_N = 0$, which is a useful feature in the later stages of the analysis.

$$E\pi * (N*) = \frac{e^{-\lambda_\mathrm{L}\lambda_\mathrm{H}(N*)\hat{\gamma}}}{\lambda_\mathrm{L}\lambda_\mathrm{H}(N*)} \qquad (7)$$

The probability of bankruptcy can be explicitly expressed now that the *N** is known. Substituting *N** in $F(\hat{\gamma})$ gives $1\text{-}e^{-\hat{c}}$ where $\hat{c} = \frac{\alpha_L \alpha_H c}{(1-\delta)^{\alpha_L}\delta^{a_H}}$. The probability of bankruptcy is constant, which notably simplifies the analysis.

Wage Bargaining

In this section negotiation about the base wage is analysed. The labour market is assumed to be non-competitive so that both the employer and the employees have bargaining power. The bargaining takes place in a Nash bargain framework. At this stage of the game, both parties take the skill premium and profit share as given and take into account the anticipated decision on the optimal labour demand. The objective function of the union is as follows

$$E\widehat{U} = (1-\delta)N * \left[(1\text{-}F(\hat{\gamma})) \left(w + \frac{\tau}{(1-\delta)N *} E\pi * \right) + F(\hat{\gamma})b \right] + (T \text{ - } N * (1-\delta))b \quad (8)$$

The trade union is utilitarian, i.e. it maximises the sum of the utility of the agents. It is assumed at this stage that the union is formed by the low-skilled. This is to account for the fact that in the empirical analysis the high skilled are assumed to be university graduates, who for the most part do not take part in the centralised wage negotiation.

The first term expresses the union member's payoff when the firm remains solvent and the member is currently employed. In this state of the world the worker receives the base wage and the profit share. The second term gives the workers' payoff when the firm goes bankrupt. The alternative income *b* is exogenous. The third term expresses the fact that after the negotiations some proportion of the total number of workers can be unemployed.

If the negotiations fail, all the union members will be unemployed and will receive the benefit *b*, which means that the threat point for the union is *Tb*. The threat point for the firm is assumed to be zero profits. The threat points are symbolised by $EU^0 = Tb$ and $E\pi* = 0$ for the union and the firm, respectively. The Nash bargain has the following form.

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[4] $c = \left(\frac{\alpha_H}{\delta} + \frac{\alpha_L}{(1-\delta)} \right) \left[\frac{(1-\delta)^{\alpha_L} (\delta)^{\alpha_H}}{\alpha_L \alpha_H} \right] \left[1 - \left(\frac{\alpha_H}{\delta} + \frac{\alpha_L}{(1-\delta)} \right) \right]^{-1}$

$$\text{Max}_w \Psi = \left[EU\right]^{\mu}\left[(1-\tau)E\pi^*\right]^{1-\mu} \qquad \text{s.t. } E\pi_N^* = 0 \tag{9}$$

where μ represents the bargaining power of the union and 1- μ the bargaining power of the firm. The maximands of the union and the firm are, respectively, $EU = E\hat{U} - EU^0 = \left(1\text{-}F(\hat{\gamma})\right)\left[N^*(w-b)+\tau E\pi^*\right]$ and $E\pi^* = \dfrac{e^{-\hat{c}}}{\lambda_L\lambda_H}$. The Nash bargain must satisfy the following first order condition:

$$\Psi_w = \mu\frac{EU_w}{EU} + (1-\mu)\frac{E\pi_w}{E\pi} = 0 \tag{10}$$

The wage's effect on the utility of the union is found by differentiating the expected utility function with respect to w and making use of the optimality feature of the firm's profit function.

$$EU_w = \frac{e^{-\hat{c}}(1-\delta)N^*}{w}\left[(1-\eta)w+\eta b-\frac{\tau\eta\hat{\alpha}}{(1-\delta)N^*}E\pi^*\right] > 0 \ , \tag{11}$$

where $\hat{\alpha} = \left[\dfrac{\alpha_L}{1-\delta}+\dfrac{\alpha_H}{\delta}\right]$. The wage's effect on the profits is similarly found to be

$$E\pi^*_w = -\frac{\eta\hat{\alpha}}{w}E\pi^* < 0 \tag{12}$$

Using these, we can solve from equation (12) the bargained base wage w^N explicitly.

$$w^N = \frac{(1-\mu)\eta\hat{\alpha}+\mu\eta}{\mu(\eta-1)+\left[e^{-\hat{c}}\tau\eta\Delta\bar{c}+(1-\mu)\eta\right]\hat{\alpha}}b > 0 \quad \text{where } \bar{c} = \frac{\delta^{a_H}(1-\delta)^{a_L-1}}{a_L a_H c} \tag{13}$$

According to (13), the bargained wage is multiplicatively dependent on the alternative income b. It is also seen that both the profit share τ and the skill premium r (embedded in Δ) have wage-moderating effects. This is in line with the theoretical results by Jerger & Michaelis (1999) and receives empirical support from Bell & Neumark (1993). However, there is also contradicting evidence. Wadhwani & Wall (1990) find no relation between the base wage and profit sharing. It is good to note that if there is no profit sharing the skill premium has no effects on the negotiated wage. The negotiated wage is also increased by the probability of bankruptcy ($e^{-\hat{c}}$ goes down) and naturally by the relative bargaining power of the union μ.

Determination of the skill premium and the profit share

Now we turn to analyse the firm's decision on the skill premium and the profit share. The firm acts in anticipation of optimal decisions in the later stages of the game. The firm acts to maximise the profit after the profit sharing by choosing r and τ.

$$\underset{r,\tau}{Max}\ \Omega = (1-\tau)E\pi^* \quad \text{s.t. } E\pi^*_L = \Psi_W = 0 \tag{14}$$

The solutions have to satisfy the system of first order conditions in (15) and (16).

$$\frac{\partial \Omega}{\partial \tau} = \underbrace{-E\pi *}_{<0} + \underbrace{(1-\tau)\underbrace{E\pi_{w^N}}_{<0}\underbrace{\frac{\partial w^N}{\partial \tau}}_{<0}}_{>0} = 0 \quad (15)$$

$$\frac{\partial \Omega}{\partial r} = (1-\tau)E\pi *_{\tilde{w}} \left[\underbrace{\Delta \frac{\partial w^N}{\partial \Delta}\frac{\partial \Delta}{\partial r}}_{<0} + \delta w^N \right] = 0 \quad (16)$$

We see that the profit share is determined so that the negative dilution effect described by the first term is offset by the second term, which captures the profit share's marginal effect on the profits. The profit share decreases wages and so increases profits. It can be calculated that higher elasticity of labour demand leads to a lower profit share as it decreases the wage-moderating effect. The intuition behind this result is that wage moderation is needed less since labour costs can be adjusted through employment management. The skill premium is also chosen so that the premium's wage-moderating effect is offset by the profit reducing effects. The first order conditions yield (see Appendix A)

$$\Delta = \frac{(\eta\hat{\alpha}+1)\left((1-\mu)\eta\hat{\alpha}+\mu(\eta-1)\right)}{\overline{c}e^{-\hat{c}}\left((\eta\hat{\alpha})^2-\eta\hat{\alpha}^2\right)} > 0 \quad (17)$$

$$\tau^* = \eta(\eta-1)\frac{\hat{\alpha}}{\hat{\alpha}\eta^2+1} > 0 \quad (18)$$

It is seen that Δ and thus the skill premium for skilled workers (r) is positively dependent on the probability of bankruptcy. It can also be calculated that the elasticity of labour demand ($-\eta$) has a negative effect on the skill premium when large enough. The technology parameter $\hat{\alpha}$ has an ambiguous effect on the skill premium. The skill premium is also negatively dependent on the bargaining power of the low-skilled, which is natural. An increase in it reduces the negotiated wage, which lowers the utility of the low skilled.

It can be seen that the optimal profit share lies between zero and one, naturally. The sign of the marginal derivative with respect to the elasticity of labour demand $\partial\tau / \partial(-\eta)$) is negative $-\eta^2\hat{\alpha} - 2\eta + 1 < 0$, for $\eta > 1$. More elastic labour demand leads to lower profit sharing, which follows from the fact that labor demand elasticity diminishes the wage-moderating effect of profit sharing. Profit sharing is directly positively dependent on the technology parameter $\hat{\alpha}$, and thus on productivity. As has been discussed, the labour demand elasticity is also negatively dependent on the productivity shocks. The technology parameter $\hat{\alpha}$ has a positive effect on rent sharing.

Job search model

The job search model follows the Burdett and Mortensen (1998) type job search equilibrium in the labour market, as analysed by Barth and Dale-Olsen (2001). This model is used to control for the labor supply effects in the model presented above. This is important in the empirical modelling as rent sharing could be partly explained by job search instead of the human capital attached to the firm. Let all separations of workers be voluntary and proportional to employment at a given level of firm-level wages, and let respective hirings follow random matching and be independent of firm employment.

We consider average labour supply effects over the period, setting hirings equal to separations in a steady state. Employment follows $H(w) = HR(w)/SRR(w)$ with the usual properties for hirings $\partial HR/\partial w > 0$ and separation rate $\partial SRR/\partial w < 0$ (The denominator in SRR is the average of employment in the current and previous period). Let σ be the probability of all workers to receive a job offer and $F(w)$ to show the wage offer distribution. Employed workers accept the wage offer if the wage level is from $1-F(w)$. The probability of separations is given by $SRR(w) = \sigma_0 + \sigma[1-F(w)]$, where σ_0 shows the exogenous separation. Since the wage premium is zero for the non-employed workers $F(w)$=0, all unemployed workers accept the wage offer. The firm hires employed workers who receive less than w. The distribution of workers over wages is given by $G(w)$. The hiring function is given by

$$HR(w) = \sigma \frac{U}{M} + \sigma G(w) \frac{N-U}{M} \tag{19}$$

where U is the number of unemployed workers, N is the labour force and M is the number of firms in the economy. The second term shows that employers hire only workers with lower w from other firms. The inflow of new persons to the job market at a wage less than w is $\sigma U F(w)$. In an equilibrium this equals the outflow of employees at a wage less than w into better-paying jobs owing to exogenous separations or quits $SRR(w)G(w)(N-U)$. This, together with the steady state flow rate into and out of unemployment $\sigma_0(N-U) = \sigma U$, gives the hiring function

$$HR(w) = \frac{\sigma\sigma_0}{SRR(w)} \frac{N}{M} \tag{20}$$

Inserting the expression for the hirings function into $H(w) = HR(w)/SRR(w)$ gives the steady state labour supply to each firm by:

$$H(w) = \frac{\sigma\sigma_0}{\left(\sigma_0 + \sigma[1-F(w)]\right)^2} \frac{N}{M} \tag{21}$$

and the elasticity of labour supply to each establishment with respect to firm-level wages is given by

$$\varepsilon(w) = \frac{\partial H}{\partial w}\frac{w}{H} = 2\sigma \frac{f(w)}{\sigma_0 + \sigma[1-F(w)]} w \tag{22}$$

which may also be written as

$$\varepsilon(w) = -2\frac{\partial SRR}{\partial w}\frac{w}{SRR} = -2\frac{\partial SRR}{\partial \psi}\frac{1}{SRR}. \tag{23}$$

The elasticity of labour supply is estimated using (22) and (23) following Barth and Dale-Olsen (2001).

3. The Empirical Formulation

We use data on individual employees from the Employment Statistics. This is a large data base that combines various registers kept by Statistics Finland and other authorities. After decomposing wages as shown below, we matched the data to firms in the sample of Financial Statistics held by Statistics Finland (see Appendix B for details). The data allow us to separate compensations based on education/sex, unobserved human capital (person effect) and firm-specific payments (firm effect). The empirical formulation follows Abowd, Kramarz and Margolis (1999) in such a way that the person-effects are estimated before the firm-effects. The two-stage approach can be justified by the low correlation of the person and firm effects (below 0.006, not shown). The basic model for the log of the wage of a person *i* working in firm *j* at time *t* is

$$\ln(w_{\text{ijt}}) = \theta_i + \psi_{J(i,t)} + \beta x_{it} + e_{ijt}. \qquad (24)$$

βx_{it} shows time-varying person characteristics: experience and time dummies; hence it contains time dummies, a dummy indicating whether person *i* has switched jobs and experience up to the fourth power. θ_i is the time invariant individual fixed effect. ψ_j captures the effect of unmeasured employer heterogeneity, where $J(i,t)$ indicates the employer of *i* at date *t*. e_{ijt} represents a statistical error term. The wage model at first stage includes only time varying characteristics βx_{it} and $\overline{x}_i \overline{y}_j$ showing interactions of person average $\overline{x}_i$ and firm characteristics $\overline{y}_j$ (interactions of average experience with the average number of workers and its second power, with the average number of workers times seniority and its second power and with 35 industry dummies, with 35 industry dummies times seniority). The estimation uses 12,824,574 observations and is done in two periods, years 1987-1992 and 1993-1998, and in each period using deviations from the individual means to purge the person-fixed effects. The subsequent error term includes, in addition to the original error e_{ijt}, the projection of the firm effects on the interaction variables. The person effect is the person average of the original error: $\theta_i = mean_i(\ln(w_{it}) - \hat{\beta}_1 x_{it} - \hat{\beta}_2 \overline{x}_i \overline{y}_j)$, where $\hat{\beta}_1$ and $\hat{\beta}_2$ are the estimated values of the coefficients.

The firm effect ψ_{jt} is the difference between $\ln(w_{it}) - \hat{\beta}_1 x_{it} - \hat{\beta}_2 \overline{x}_i \overline{y}_j$ and person effect θ_i. Let $q_{jt} \equiv QR_{jt} / L_{jt}$ denote quasi rent per worker. The decomposition of the firm effect uses 10,851,754 observations (year 1989 dropped since hirings rate is not obtainable) to estimate

$$\psi_{jt} = \phi_{jt} + \gamma_{1j} q_{jt} + \gamma_{2j} HR_{jt} + \gamma_{3j} s_{it} + \gamma_{4j} s_{it}^{\ 2} + \varepsilon_{jt} \qquad (25)$$

where ϕ_j is a firm intercept, slope, γ_{1j} is quasi rent slope, γ_{2j} is hirings HR_{jt} slope, γ_{3j} is seniority slope for seniority s_{it}, γ_{4j} is seniority-squared slope, and ε_{jt} is the statistical error term. The quasi rent effect $\gamma_{1j} q_{jt}$ measures the extent of rent sharing. Following Abowd and Kramarz (1996) the quasi rent is obtained by

$$QR_{it} = v_{jt} - 0.03k_{jt} - (1 + \theta_{it} - \overline{\theta})\overline{w}, \tag{26}$$

where v_{jt} is value added, k_{jt} is real capital per worker (obtained by aggregating plant level investment), θ_{it} is the person effect and $\overline{\theta}$ and $\overline{w}$ are grand average person effect and wages, respectively. (Wage expenses are from total expenditures on labour divided by the number of employees from financial statistics. Value added per worker is value added divided by the producer price index at the two-digit level.) Transferable human capital, as captured in person effect θ_{it}, determines the opportunity income of the individual i. Note that quasi rent receives a negative value if value added is not obtainable. The analysis here uses, however, only employee data linked to firm-level data (see Appendix B for details).

The estimation procedure of the labor supply is similar to Barth and Dale-Olsen (2001) with the exception that they estimated firm effects by using firm dummies. Half of the firm's average churning, the minimum of hirings or separations, min (HRR, SRR), is explained by the position of the establishment in the wage offer distribution $1-F(\psi)$, to obtain estimates of σ_0 and σ, where ψ is the firm effect in (25). The rationale for using this measure instead of the separations rate is that it shows the turnover keeping the desired stock of employees constant. For declining firms (separations exceed hirings), it gives figures for replacement hirings.

The kernel estimation of firm-level wage distribution is shown for age group 28-38 in Figure B.1 and for age group 39-49 in Figure B.2. It is seen that biweight kernel distribution (thick lines) approximately follows normal distribution (thin lines) after dropping extreme observations with firm-level wages deviating 170 percentage points from the average level of firm-level wages.

The estimated values for σ_0 and σ in explaining half of the churning level for the position of the firm in the wage offer distribution $1-F(\psi)$ obtain significant values at the 2% level. (R-squares for prime age workers is 0.5% with 1691 observations and for experienced workers 0.6% with 1739 observations.) The average labour supply elasticities faced by each firm are obtained using (22) and (23). Table 1 shows the elasticities used in our statistical analyses separately for age groups 28-38 and 39-49 (see also table B.1 in Appendix B).

Table 1. The Labour Supply Faced by Each Firm

Dependent Variable	Prime age workers				Age group 39-49			
	Lower Educated		Higher Educated		Lower Educated		Higher Educated	
Variable	mean	std	mean	std	mean	std	mean	std
0.5*Churning	0.030	0.081	0.040	0.084	0.030	0.084	0.048	0.121
Exogenous separation rate ρ_0	0.024		0.036		0.021		0.031	
Probability for Job Offer ρ	0.019		0.010		0.021		0.011	
Probability for Separation $\rho_0+\rho[1-F(w)]$	0.042		0.046		0.042		0.042	
Labour Supply elasticity	0.415	0.916	0.184	0.432	0.413	0.865	0.206	0.470

It is seen that the *exogenous separation rate* σ_0 for prime age workers is 2.4 percentage points for the lower educated and 3.6 percentage points for the highly educated. These figures are overestimates of exogenous separations into unemployment, since they also include job-to-job flows. The exogenous separation rates for age group 39-49 show lower rate both for the lower educated (2.1) and for highly educated (3.1). For lower educated *the probability of job offers* σ is of the same magnitude as exogenous separations σ_0 (1.9 for prime age and 2.1 for experienced workers). The mobility of highly educated is instead explained more by exogenous separations and is less sensitive to the position of the firm in the distribution of firm-level payments (1.0 for prime age and 1.1 for experienced workers). This implies that the job switches of highly educated are less dependent on the position of the firm in the wage offer curve.

The labour supply elasticity is around 0.4 for lower educated prime age workers and 0.2 for highly educated prime age workers. The elasticities are roughly the same for experienced workers. The elasticity estimates for prime age workers are one-half or less than in Barth and Dale-Olsen (2001) in Norway. The patterns are similar with lower labour supply elasticity for the highly educated, although the standard deviation of around 0.4 is large (the maximum value is 1.9 for high education and 3 for low educated). The conclusion is that the supply is rather inelastic. The job mobility of highly educated experienced workers is, in particular, fairly unrelated to the position of the firm in the wage offer distribution. Job-to-job mobility for other exogenous reasons takes an important role.

4. Rent Sharing in Finnish Firms

The empirical estimating is carried out for the half of firms, where the rent sharing is highest.[5] The estimates for all firms are roughly similar, but the model has substantially less predictive power. The quasi-rent effect (as well as the firm effect) is on the average 1.6 percent for the employees in the half of the firms with highest rent sharing (see table B.1 in Appendix B).

Kruse (1996) finds that company pay trends and related wage pressures do not encourage firms to use more profit sharing. In our model, we also find no relation in the empirical estimations between wage compensations that relate to transferable human capital (compensations for general experience, education and unobserved human capital) and quasi-rent effects. Wage components showing transferable human capital are thus excluded from the model. The quasi rent effect is also rather independent of the position of the total firm effect. The quasi-rent effect is only mildly negatively correlated with the firm effect for prime age workers (around –0.07) and mildly positively correlated for experienced workers (around 0.08), see table B.2 in Appendix B. It is seen from table B.2 that the quasi-rent effect is, however, strongly negatively correlated with firm intercept (around –0.7). This suggests that rent sharing has a wage-moderating effect, as predicted by our theoretical model, see equation (14). The negative correlation is lower in the firms with negative rent sharing.

The estimation uses the Arrelano and Bond (1991) IV (GMM) method. Table 2 summarises the results for the determinants of rent sharing for prime age workers.

The results are similar in both magnitude and precision to the results of other specifications that do not involve unrestricted time and industry effects. It is seen that lagged values of quasi-rent effect imply a 15-20% higher long-term adjustment compared with immediate effects. This shows a rather immediate adjustment in rent sharing, albeit with some greater persistence in quasi-rent payments for prime age lower educated workers (column 2 in table 2).

Job search explanations for rent sharing

The firm-specific labour supply elasticities capture the importance of job-to-job search in the setting of the optimal wage policy. Consider first the labour supply elasticity of prime age workers from Table 2. It is seen that for prime age highly educated workers the positive labour supply effect is significant on the 1% level in all the regressions. Although labour supply elasticity is less than for the lower educated (see table 1), rent sharing responds more strongly to any changes in it. For low educated the relationship between labour supply elasticity and rent sharing is instead weak in column 2.

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5 The median firm has negative rent sharing with –0.66 for prime age and -0.09 for experienced workers.

Table 2. Estimates of The Determinants of Rent Sharing, Prime Age Workers

Dependent Variable	All		Lower Educated		Higher Educated		Small Firms		Large Firms	
Variable	**Coefficient**	**z-value**	**Coefficient**	**z-value**	**Coefficient**	**z-value**	**Coefficient**	**z-value**	**Coefficient**	**z-value**
Quasi Rent Effect$_{t-1}$	0.397	**(7.0)**	0.145	**(1.8)**	0.235	**(3.9)**	0.099	**(5.2)**	0.373	**(5.2)**
Log Capital per Worker$_{t}$	-0.014	**(3.2)**	0.021	**(4.2)**	-0.032	**(6.9)**	0.003	**(3.5)**	-0.015	**(3.5)**
Log Capital per Worker$_{t-1}$	0.010	**(3.2)**	-0.003	(0.8)	0.020	**(4.5)**	0.013	(0.3)	0.001	(0.3)
Labour Supply Elasticity η_{Lt}	-0.095	**(6.2)**	0.020	**(2.4)**	0.000	(0.0)	0.000	**(2.9)**	-0.012	**(2.9)**
Labour Supply Elasticity η_{Ht}	0.370	**(14.0)**	0.000	(0.0)	0.286	**(9.2)**	0.081	**(10.3)**	0.121	**(10.3)**
Borrowing Ratio	-0.004	**(3.4)**	-0.005	**(3.5)**	-0.004	**(3.1)**	-0.001	**(1.7)**	-0.002	**(1.7)**
η_{Lt}R&D Intensity	0.070	**(4.4)**	-0.018	**(1.7)**	0.000	(0.0)	-0.048	(0.0)	0.000	(0.0)
$\eta_{Ht,}$ R&D Intensity	-0.245	**(9.2)**	0.000	(0.0)	-0.207	**(7.0)**	-0.274	(0.0)	0.000	(0.0)
R&D Intensity	0.093	**(7.1)**	-0.019	**(1.9)**	0.119	**(7.2)**	0.075	**(3.0)**	-0.025	**(3.0)**
Hirings Effect$_{Lt}$	-0.041	**(2.2)**	-0.149	**(5.0)**	-0.053	**(2.5)**	-0.025	**(5.6)**	-0.139	**(5.6)**
Hirings Effect$_{Lt-1}$	-0.044	**(2.8)**	-0.066	**(2.7)**	-0.027	(1.5)	-0.013	**(2.1)**	-0.045	**(2.1)**
Hirings Effect$_{Ht}$	-0.060	**(3.2)**	-0.106	**(3.9)**	-0.078	**(3.5)**	-0.006	**(6.8)**	-0.161	**(6.8)**
Hirings Effect$_{Ht-1}$	-0.046	**(2.9)**	-0.066	**(2.8)**	-0.030	(1.6)	-0.002	**(2.3)**	-0.049	**(2.3)**
Seniority Effect	-0.133	**(6.1)**	-0.041	(1.6)	-0.187	**(6.7)**	-0.116	(1.2)	-0.049	(1.2)
Higher Educated/Employees$_{t}$	0.014	**(1.8)**	-0.008	(0.5)	0.010	(1.2)	0.032	(0.9)	-0.008	(0.9)
Job Switcher	-0.010	**(5.5)**	-0.022	**(8.3)**	-0.015	**(7.1)**	-0.014	**(7.2)**	-0.016	**(7.2)**
number of obs.	4116		1310		2806		1752		2267	
number of groups	2303		720		1583		1021		1333	
Wald Chi (30)	786.02		279.41		558.54		558.36		532.39	
Sargan test Chi^2 , (d.f)	120.16	(152)	86.60	(131)	88.65	(110)	90.31	(152)	126.48	(110)
Sargan test P>Chi^2	0.97		0.999		0.933		1.000		0.135	
AR(2) test (z)	-0.53		0.88		-0.4		0.11		-1.62	

(i) Estimations include time dummies, six firm-size dummies and column 1 six industry dummies (manufacturing, IT industry, energy industry, construction, retail, services). (ii) Capital, labour supply elasticity and its interaction to r&d intensity and borrowing ratio are treated as endogenous. (iii) Only employees with more than 3 observations have been selected. (iv) The estimations in the first column include five industry dummies: IT-industry 0.091 (4.96), construction -0.108 (7.24), trade 0.123 (4.7), Services 0.149 (4.31).

Table 3. Estimates of The Determinants of Rent Sharing, Age 39-48

Dependent Variable	**All**		**Lower Educated**		**Higher Educated**		**Small Firms**		**Large Firms**	
Variable	**Coefficient**	**z-value**	**Coefficient**	**z-value**	**Coefficient**	**z-value**	**Coefficient**	**z-value**	**Coefficient**	**z-value**
Quasi Rent Effect$_{t-1}$	0.372	**(10.9)**	0.169	**(4.1)**	0.304	**(10.4)**	0.021	(0.6)	0.227	**(11.0)**
Log Capital per Worker$_t$	0.009	**(2.0)**	-0.006	(1.3)	-0.010	(1.7)	-0.015	**(4.6)**	-0.011	**(3.4)**
Log Capital per Worker$_{t-1}$	0.001	(0.3)	0.006	(1.6)	-0.007	**(2.5)**	-0.003	(0.7)	-0.001	(0.7)
Labour Supply Elasticity η_{Lt}	0.020	**(3.6)**	0.015	**(1.7)**	0.000	(0.0)	-0.206	**(8.0)**	0.040	**(7.3)**
Labour Supply Elasticity η_{Ht}	-0.034	**(3.3)**	0.000	(0.0)	0.245	**(13.9)**	0.418	**(29.6)**	0.042	**(3.7)**
Borrowing Ratio	-0.006	**(4.4)**	-0.002	(1.1)	-0.004	**(2.9)**	-0.006	**(6.1)**	-0.002	**(2.0)**
η_{Lt}R&D Intensity	0.000	(0.0)	-0.002	(0.2)	0.000	(0.0)	0.189	**(7.1)**	-0.010	(1.6)
$\eta_{Ht,}$ R&D Intensity	0.000	(0.0)	0.000	(0.0)	-0.424	**(14.5)**	-0.559	**(23.6)**	-0.241	**(14.4)**
R&D Intensity	0.008	(1.2)	0.029	**(3.1)**	0.168	**(11.4)**	0.135	**(13.5)**	0.139	**(15.8)**
Hirings Effect$_{Lt}$	-0.066	**(3.3)**	0.008	(0.3)	-0.009	(0.4)	0.015	(0.7)	-0.042	**(2.3)**
Hirings Effect$_{Lt-1}$	-0.034	**(2.1)**	-0.043	**(2.0)**	0.015	(0.9)	0.009	(0.5)	-0.002	(0.1)
Hirings Effect$_{Ht}$	-0.012	(0.6)	0.046	**(1.7)**	0.017	(0.8)	0.068	**(2.8)**	-0.014	(0.8)
Hirings Effect$_{Ht-1}$	-0.039	**(2.4)**	-0.044	**(2.1)**	0.012	(0.7)	0.016	(0.8)	-0.004	(0.2)
Seniority Effect	-0.113	**(8.7)**	-0.041	**(3.5)**	-0.178	**(8.3)**	-0.109	**(6.1)**	-0.123	**(8.4)**
Higher Educated/Employees$_t$	0.016	(1.6)	-0.015	(0.9)	0.020	**(2.1)**	0.062	**(5.1)**	0.002	(0.3)
Job Switcher	-0.018	**(8.9)**	-0.009	**(3.1)**	-0.019	**(9.3)**	-0.020	**(7.3)**	-0.013	**(7.4)**
number of obs.	4730		1762		2968		1635		2956	
number of groups	2347		859		1488		917		1466	
Wald Chi (30)	604.87		222.52		1150.28		2131.8		1176.95	
Sargan test Chi^2 , (d.f)	159.4	(110)	166.03	(132)	131.68	(110)	73.50	(152)	341.48	(152)
Sargan test P> Chi^2	0.00		0.02		0.08		1		0.00	
AR(2) test (z)	0.61		0.73		-0.28		-0.3		-0.38	

(i) Estimations include time dummies and six firm-size dummies. (ii) Capital, labour supply elasticity and its interaction to r&d intensity and borrowing ratio are treated as endogenous. (iii) Only employees with more than 3 observations have been selected.

It can be seen from Table 3 that for experienced workers at age 39-49, higher labour supply elasticity also has a positive effect on rent sharing for highly educated. (The first columns in Tables 2 and 3 are not directly comparable since in Table 2 includes industry dummies.) Firms that have high-educated experienced workers with a high propensity to leave practise more intense rent sharing. Recall that the quasi rent effect for highly educated, 2 percent, is double compared with the lower educated, 1 percent, while the standard deviation is not lower. It can be concluded that job search explanations are important for imposing rent sharing for highly educated. High skill premium, as for highly educated, associates with more intense rent sharing.

The human capital model and firm factors in explaining rent sharing

It is seen that job switchers have received substantially lower rent sharing in the following year irrespective of the education level. This shows signs of a significant loss in firm-specific human capital. Let us next consider firm factors and the human capital model as outlined in Section 2.

Bankruptcy risk

The human capital model has the property that the probability of bankruptcy has a negative effect on rent sharing from (A1) although it increases the skill premium. The reason is that in bad firms rent sharing does not moderate wages to the same degree as in firms performing well (see eq.13). Using the borrowing ratio (interest expenses on debt per cash flow) as a proxy for the probability of bankruptcy we find bankruptcy to have negative effects on rent sharing. A negative relation between rent sharing and bankruptcy risk can also follow from the increased threat of losing one's job in wage negotiations that is not explicitly modelled.

Labour demand elasticity

The hiring effect, one component of the firm-level wage component in (25), shows to what degree a change in firm-level compensations can be explained by a change in hirings. It shows thereby the degree by which employment management can be practised instead of rent sharing. It can be seen form Table B.1 in the Appendix B that hirings have, on the average, a negative effect on the wage premium. The more firm-level wages go up for a given decrease in hirings, the less easy it is to let employment rather than wages and rent sharing go down. It is seen from Tables 2 and 3 that the hirings effect on rent sharing is, on the average, negative. This suggests that more elastic labour demand (less negative hirings effect) allows the firm to lower the level of rent sharing. For prime age workers this is evident in all age groups and large firms. The hirings effect for the age group 39-49 is significant only for the lower educated and in large firms.

Skill intensity of the firm

Consider next the skill intensity or the technology level of the firm. Our theoretical model implies that skill intensity, as captured by $\hat{\alpha}$ in (18), leads to higher rent sharing. This is supported by the implied lower labour demand elasticity. The skill intensity measures include the capital and R&D intensity. (Around half of the firms have R&D investment in some year (indicating oversampling) and classified as R&D intensive.) It is seen from Table B.1 in Appendix B that the rent sharing is twice as high for highly educated experienced workers in R&D intensive firms as in other firms (2.4 percent in contrast to 1.2 in other firms). There is also some sign of less elastic labour demand. The hirings effect for highly educated is more negative in firms with R&D investment (-0.22 in R&D intensive firms in contrast to –0.005 in other firms) while it is approximately the same for non-educated (0.02 as contrast to 0.09).

It is also seen in Tables 2 and 3 that rent sharing increases with R&D intensity especially if labour supply is fairly inelastic, since the interaction of R&D intensity and labour supply elasticity has a negative sign in all regressions (dropped in some estimations for experienced workers). This shows the importance of the human capital theory over the job search model to explain the wage policy in R&D intensive firms. The amortisation period for firm-specific human capital investments is long. The emphasis in wage policy is on the work effort of experienced workers as rent sharing is higher for the age group 39-48 (2.4% as compared to 1.5% in Table B.1). This is despite that fact that R&D intensive firms are fairly young and the average seniority of the highly educated is 14 years, compared to the average 16 years in other firms (see Table B.1 in Appendix B). Following human capital models such as Pakes and Nitzan (1983) and Moen (2000), young workers can also expect high wages in the future and starting wages and rent sharing can be moderate. The reason is that workers in an R&D-intensive firm get access to valuable knowledge in the firm.

It is seen from Tables 2 and 3 that a higher proportion of the highly educated workers in the firm has ambiguous effects on rent sharing, as is also evident from the theoretical model. The technology parameter $\hat{\alpha} = \frac{\alpha_L}{1-\delta} + \frac{\alpha_H}{\delta}$ and the share of the highly educated δ are positively related only for sufficiently high share of the highly educated. It is likely that rent sharing is preferred if the share of high skilled is sufficiently high.

Kruse (1996) also gives some additional arguments as to why rent sharing in skill-intensive firms can be preferable to individual incentives (when capital intensity is high). One reason is that production is highly interdependent and the technology is not stable. Supervision is, subsequently, costly and shirking by employees becomes a concern. Flexible production implies the difficulty of implying any piece rate system. As a result, the wage premium for skilled workers and the profit share arises.

Finally, capital intensity is important and tends to have a negative effect on rent sharing for the highly educated. This suggests that physical and human capital can also work as substitutes so that heavy use of physical investment mitigates the rent sharing. The negative effect is probably also a consequence of other skill intensity variables such as R&D intensity capturing the effects often embedded in capital as an explanatory variable. Human capital model clearly explains rent sharing in R&D intensive firms and physical capital is a bad approximation for human capital.

Rent sharing versus other firm-level payments

It has been stated early on that rent-sharing leads to moderation of firm-level wages as there is a strong negative correlation between rent sharing and starting wages (firm intercept). The alternative firm-level compensation schemes include seniority payments (evaluated by the sum of seniority and seniority squared effects). It is seen that the seniority effect indeed has a negative effect on rent sharing. Seniority payments and rent sharing thus work as substitutes, and especially for the highly educated workers.

Firm-size and industry effects:

Rent sharing is fairly similar in small and large firms, although in small firms the lagged value of quasi rent receives significantly lower value. Rent sharing is more persistent in large firms. Another clear difference is the more negative hirings effects in large firms. Large firms can more easily moderate rent sharing, as labour demand is more elastic.
The model excludes industry dummies except for those in the estimation for experienced workers (not reported). The main finding is that rent sharing is more common in the manufacturing sector. In the IT sector, also lower educated experienced workers participate in rent sharing. In the service sector, the rent sharing of the highly educated is surprisingly low.

7. Conclusions

Wage formation is crucially dependent on the education/skill level of employees and the experience gained. After taking the worker heterogeneity into account, all the empirical results have been quite consistent with the predictions of our theoretical model. Job seeking and human capital models both explain the rent sharing paid to the personnel. Rent sharing aims at moderation of wages, which becomes more effective as the skill premium for high skilled goes up. It is shown that rent sharing is negatively correlated with firm-level fixed payments (starting wages). We do not find any clear relation between compensations on transferable human capital or the firm effect and rent sharing. In this way rent sharing can be quite independent of wage pay trends, but is clearly a substitute for other firm-level incentive schemes. One implication of the model is that the higher share of the skilled workforce has generally ambiguous effects on rent sharing, as found in the empirical part of the study.

It is seen that the job seeking of prime age workers at age 28-38 and especially with higher education is one of the main targets of rent sharing. Prime age workers have only moderately higher labour supply elasticity but the sensitivity of rent sharing to this is strong. Highly educated workers have lower labour supply elasticity than lower educated workers but respond more strongly to changes in profit sharing. Job search explanations are important in non-R&D intensive firms.

Human capital models explain rent sharing for experienced workers in skill-intensive firms better. Rent sharing is especially common in R&D intensive firms where the labour supply is fairly inelastic. This also shows the relative unimportance of the job search theory in the wage policy in technology firms. In R&D intensive firms rent sharing relates to human capital accumulation and is not paid in order to accommodate labour costs for economic performance (the labour demand is inelastic). Rent sharing is also more common for experienced workers in the 39-49 age group. It is also possible that with the flexible technology used in R&D intensive firms, the high monitoring costs require performance-related pay systems other than seniority payments.

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Appendix A

Derivation of the first order condition of labour demand:

$$\frac{\partial E\pi(N)}{\partial N} = \frac{\lambda_H \lambda_L(N)\left[\left(-\lambda_H \lambda_L{}'(N)\hat{\gamma} - \lambda_H \lambda_L(N)\tilde{w}\right)e^{-\lambda_H \lambda_L(N)\hat{\gamma}}\right]}{\left[\lambda_H \lambda_L(N)\right]^2} - \frac{\lambda_H \lambda_L{}'(N)e^{-\lambda_H(H)\lambda_L(L)\hat{\gamma}}}{\left[\lambda_H \lambda_L(N)\right]^2} = 0$$

implying

$$\lambda_H \lambda_L(N)\left(-\lambda_H \lambda_L{}'(N)\hat{\gamma} - \lambda_H \lambda_L(N)\tilde{w}\right) - \lambda_H \lambda_L{}'(N) = 0$$

rearranging gives (6) in text

Determination of τ and *r*.

Solving for τ from (15) we get

$$\tau^* = \frac{(\eta\hat{\alpha})^2 e^{-\hat{c}}\Delta\overline{c} - \mu(\eta-1) - (1-\mu)\eta\hat{\alpha}}{((\hat{\alpha}\eta)^2 + \hat{\alpha})e^{-\hat{c}}\Delta\overline{c}} \tag{A1}$$

We can see from (A1) that the profit share is positive only for sufficiently large Δ. This implies that the skill premium and the induced wage moderation (see 13) have to be large enough in order for profit sharing to be desirable.

Solving τ:

Substituting the solution for (17) to gives (A1) gives (18).

Solving *r*:

Using $E\pi_{w^N} = E\pi_{\tilde{w}}\Delta$ (15) can be written as $\frac{E\pi^*}{\Delta} = (1-\tau)E\pi_{\tilde{w}}\frac{\partial w^N}{\partial \tau}$. Then using $\frac{\partial w^N}{\partial \Delta}\frac{\Delta}{\tau} = \frac{\partial w^N}{\partial \tau}$ and substituting the modified expression for (15) in 16 yields $\Delta = -\frac{\tau}{(1-\tau)}\frac{E\pi^*}{E\pi^*_{\tilde{w}}\, w^N} > 0$. Substituting $E\pi^*_{\tilde{w}} = -\frac{E\pi^*}{w\Delta}\eta\hat{\alpha}$ gives $\frac{\tau}{(1-\tau)}\frac{1}{\eta\hat{\alpha}} = 1$. This is an implicit expression for Δ. Using (A1) we can solve explicitly for Δ. Substitution gives (17) in text.

Appendix B. The Linked Employee-Employer Data

The original data in Employment Statistics cover 23 776 631 observations from individuals that, during 1989-1998, worked at least one year in the private sector. The plant level job and worker flow are based on 20,909,731 person-year observations after deleting (i) 71 073 observations with a missing establishment or firm code, (ii) 47 194 with missing observation years, (iii) 1 838 647 with a missing industry code, (iv) 62 648 with no sex code and (v) 697 995 observations when wages deviate more than five standard deviations from predicted value. (The OLS regression was similar to Abowd, Kramarz and Margolis, 1999, p. 326, with explanatory variables work experience up to the fourth power, six education class dummies and sex.) An individual was dropped from the data if data were missing in only some year(s).

Following the method by Baldwin, Dupuy and Penner (1992), the births and deaths of firms are considered as mere transfers of the firm, when persons employed either in the old firm at date *t-1* or in the new firm at date *t* amount to more than 60 percent of all persons working in these firms at dates *t-1* and *t.* Using this criterion, unreal deaths and births are less than two percent of all firm births and deaths and these firms are linked (even though the firm code differs). The worker reallocation rate (the sum of the hiring and separation rates) is around 0.5 percent lower after this correction.

Person and firm effect calculations are based on 12 824 574 observations (firm code non-zero). It is important to note that the time span of 10 years is sufficiently long to separate person and firm effects, requiring in every firm at least one person to experience a job switch. 556,835 observations out of the 6,136,985 observations of the first year that an individual is recorded in the firm had a missing seniority starting date. For these observations, seniority is set at 1 based on the observed firm switches. Seniority also receives the value of one if the missing date is from 1987. Therefore, since 1989 (the record starts at year 1987 but employer statistics start at the year 1989) 117,572 individuals have a seniority of 3 in year the 1989, 86,557 have a seniority of 2 in year the 1990, 63,538 in year the 1991 etc. The estimated equations include 47 industry dummies at the two-digit level or at the three-digit level used in construction and services (see above). Finally, in the calculation of the firm effects, we pooled 172 796 firms (659 708 observations) that had less than 10 observations into a single firm in the 8 main industries. Firm effects were then estimated in 65,643 firms, of which 13,530 had no workers with higher education.

The general sampling rate in data from employee statistics is 10 per cent but 50 per cent for employees with a bachelor's degree (lower university and non-university degrees) and 100 per cent for employees with a higher university degree. 50 percent of firms with an average size of 100-500 and 30 percent of firms with an average size of over 500 enter the sample. This results in 1,101,553 person-year observations from 133,371 individuals in years the 1989-1997 (after deleting the year 1998).

The total data of employees in this data is matched with the firm sample of Financial Statistics held by Statistics Finland. The 9,553 firms in the original linked employer-employee data are from the following industries: mining (nace 10-14) 23, consumer goods (nace 15, 17-19) 481, other manufacturing (nace 20-25) 605, non-metallic mineral products (nace 26, 36-37) 605, metals and machinery (nace 27-29) 807, energy and water (nace 40-43) 99, construction (nace 44-45) 670, trade (50-55) 1594, transport, not telecommunications (nace) ICT and business services (nace 30, 71-72, 741-745, 642) 684, household services (nace 746-747, 93-99) 194, transport (except telecommunications) 44, education and health. In the sample from employee statistics, 125,341 observations have a non-zero firm code that matches the firm code in financial statistics. Of these 71,421 are of the age 18-39, and 27,554 of the age 49-65 enter the study.

The variables used in the analysis for person *i* and firm *j* at time *t* from the data are (besides those discussed in the text):

Annual employment L_{jt}: Average number of salaried and hourly employees in firm *j* over the course of the calendar year in Financial Statistics.
Employment E_{kt}: Employment in establishment *k* in period *t*, determined by the employment at the end of December in each year in Employee Statistics.
Annual wages W_{it}: Real compensation (wage) for person i divided by months worked and multiplied by 12, and deflated by the consumer price index (1990=1.00) in Employee Statistics.
Years of Experience: Age minus years of education and age when school started.
Higher educated workers/Employees: The share of employees with a bachelor's degree (lower university and non-university degrees) or higher.
Seniority: Duration of a job measured in years.
Borrowing ratio: Expenditures on interest-bearing debts divided by cash flow (Nickell and Nikolitsas, 1999, use all long-term interest payments). The minimum of the borrowing ratio is set at zero and the maximum at four.

Table B.1 Summary

Variable	Prime Age		Age 39-48		Prime Age Highly Educated	Age 39-48 Highly Educated	Prime Age Low	Age 39-48 Low
	Mean	Std. Dev	Mean	Std. Dev	Mean	Mean	Mean	Mean
Age	33.07	2.91	43.33	2.59	32.98	43.25	33.25	43.45
Hirings rate L	0.08	0.19	0.08	0.19	0.09	0.08	0.08	0.07
Hirings rate H	0.09	0.18	0.08	0.19	0.09	0.09	0.08	0.08
Seniority	11.31	6.97	19.26	9.80	10.49	18.32	13.05	20.78
Seniority R&D=0	11.98	7.20	20.11	10.24	11.50	19.75	12.69	20.57
Seniority R&D=1	10.84	6.76	18.74	9.48	9.92	17.57	13.44	20.94
Education	2.79	0.85	2.61	0.96	3.29	3.27	1.73	1.54
Quasi Rent Effect on Firm Wage	0.02	0.11	0.02	0.15	0.02	0.02	0.01	0.01
Quasi Rent Effect on Firm Wage R&D=0	0.02	0.13	0.01	0.16	-	-	-	-
Quasi Rent Effect on Firm Wage R&D=1	0.02	0.10	0.02	0.14	-	-	-	-
Seniority effect	-0.04	0.15	-0.05	0.26	-0.04	-0.06	-0.03	-0.04
Hirings Effect on firm wageL	0.01	0.22	0.01	0.25	0.01	0.02	0.01	0.01
Hirings Effect on firm wageH	-0.01	0.23	-0.02	0.26	-0.02	-0.02	-0.01	-0.02
Seniority effect on firm wage	0.04	0.15	0.02	0.19	0.04	0.02	0.04	0.02
Seniority effect on firm wage2	-0.02	0.08	-0.02	0.14	-0.02	-0.03	-0.02	-0.02
Separations rate L	0.06	0.12	0.06	0.12	0.06	0.06	0.06	0.05
Separations rate H	0.07	0.14	0.07	0.14	0.08	0.08	0.07	0.07
Higher Educated / Employees	0.34	0.22	0.33	0.22	0.40	0.39	0.22	0.23
Average Employment	777	1855	881	2092	799	896	732	856
Borrowing Ratio	0.92	1.36	0.89	1.32	0.97	0.88	0.82	0.90
Firm Intercept Lower Educated	-6695.8	10071.9	-9099.9	11005.8	0.0	0.0	-6695.8	-9099.9
Firm Intercept Higher Educated	-9407.6	14562.0	-15255.8	20505.3	-9407.6	-15255.8	0.0	0.0
Job Switcher	0.12	0.32	0.11	0.31	0.13	0.12	0.10	0.09
R&D intensity	0.59	0.49	0.62	0.49	0.64	0.66	0.48	0.56
η_LR&D intensity	0.24	0.74	0.23	0.68	0.26	0.26	0.20	0.20
η_LFirm Intercept Lower Educated	0.13	0.36	0.14	0.35	0.15	0.16	0.10	0.09
η_LBorrowing Ratio	0.36	1.54	0.36	1.54	0.39	0.37	0.28	0.35
η_HR&D intensity	0.10	0.33	0.11	0.35	0.10	0.12	0.10	0.10
η_HFirm Intercept Higher Educated	0.06	0.15	0.07	0.18	0.06	0.08	0.04	0.04
η_HBorrowing Ratio	0.14	0.60	0.17	0.73	0.14	0.18	0.14	0.16
Log Capital Per Worker	0.00	1.34	0.14	1.42	0.02	0.16	-0.07	0.11

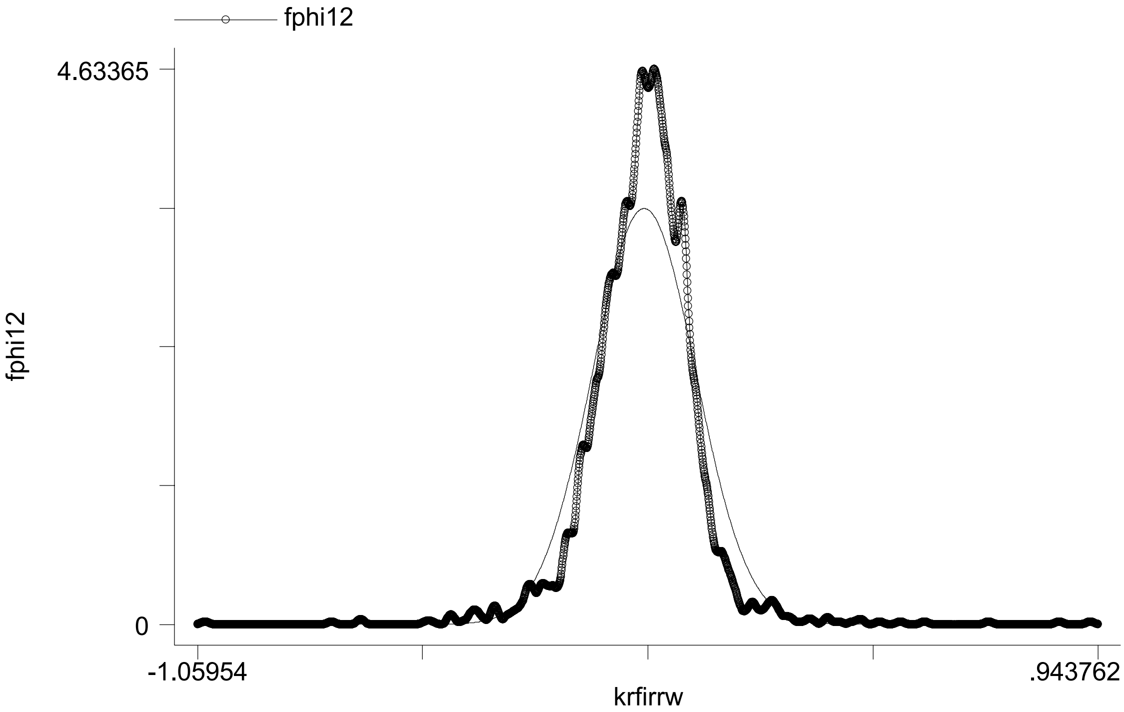
Only employees with more than 3 observations have been selected. Firm variables refer to the unweighted average figures in firms that have these type of workers.

Table B.2 Correlations of Quasi-Rent Effect with Firm-Level Payments

	Prime Age Workers		Older Workers	
Variable	Unskilled	Skilled	Unskilled	Skilled
Firm Effect	-0.08	-0.07	0.09	0.07
Firm Intercept	-0.74	-0.73	-0.77	-0.81
Seniority Effect	-0.02	-0.01	0.05	0.01
Seniority Squared Effect	-0.06	-0.13	-0.17	-0.17
Hirings $Effect_L$	0.01	0.01	0.03	0.01
Hirings $Effect_H$	-0.02	-0.02	-0.04	0.00

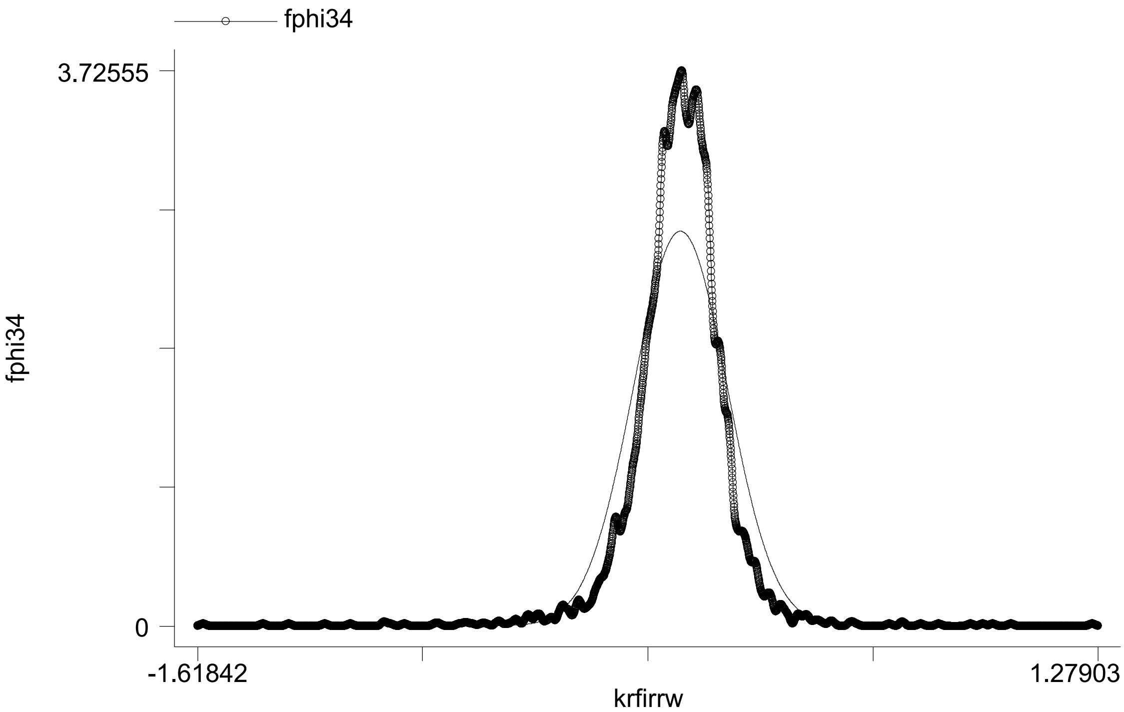
Correlations are calculated using the original data with 10 223 902 person-year observations.

Figure B.1



Kernel Density Estimate

Figure B.2



Kernel Density Estimate

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THE RESEARCH INSTITUTE OF THE FINNISH ECONOMY
LÖNNROTINKATU 4 B,   FIN-00120 HELSINKI

Puh./Tel. (09) 609 900 Telefax (09) 601753
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