Effects of wages on job tenure

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Abstract

In this article, the effect of wages on the job tenure is studied using microeconomic data on industrial companies. The data cover a period of 11 years starting from the first quarter of 1980 and contain several pieces of information on workers, jobs, and companies. The models were estimated in a competing risk framework. According to the results the wage groups of the workers and relative wage within a company are positively related to the job tenure. These effects are larger among the persons who leave the industry than among the persons who find new industrial jobs. © 2001 Elsevier Science Inc. All rights reserved.

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1. Introduction

The econometric analysis of labour-market transition data has in recent years become an active area of empirical research. It is known also as a hazard-function approach to duration data analysis, where the transition intensity to a new state is modeled using econometric methods. In these studies, the process of state-to-state is based on the lengths of certain spells of time.

In this study, the dynamic features of transitions from employment in Finnish industry are analyzed. Special emphasis is devoted to the effects of wages on the probability of exiting from a company. We analyze whether the workers having lower wages differ from
those having higher wages. In addition, we examine the effects of many other factors, which have been stipulated in the labour agreements and which affect the probability of leaving the job.

In an economic model, companies are assumed to pay the costs of labour turnover, which are the fixed training costs for each worker. It is argued that by paying higher wages, the company can lower labour turnover and hence, raise its expected returns on specific training.

The empirical analysis is carried out in the competing risk framework. It makes possible to take into account the feature that employment spells may be terminated by different outcomes. The data allow one to make a distinction between the workers who change their jobs within Finnish industry or leave it.

An exhaustive survey of the literature of the movements from unemployment to employment is found in Devine and Kiefer (1991). Job-matching models of Gottschalk and Maloney (1985), Jovanovic (1984), Miller (1984), and a search model of Albrecht, Holmlund, and Lang (1991) incorporate uncertainty of wages or unobservable job-specific characteristics and constitute a theoretical framework for job-to-job transitions. In addition, there is a huge body of literature on the duration of employment (see Becker & Lindsay, 1994; Brown & Light, 1992; Gritz, 1993; Kiefer, 1988).

Belzil (1993) has analyzed in his study the statistical relationship between accepted job duration and the job-to-job transition strategy using Canadian data. He found that jobs preceded by unemployment tend to be shorter than the jobs preceded by employment. For those who have comparative advantages in searching for a job, choosing unemployment does not seem to raise the subsequent job duration. If similar reasoning is valid for Finland, we could expect that long spells of employment tend to be followed by job-to-job transitions.

This study is organized as follows. In Section 2, the theoretical background of the determination of the wage is exposed briefly. The data of this study are presented in Section 3. The econometric models and the results of estimations are presented in Section 4. The Section 5 summarizes and discusses the results of the study.

2. Determination of the wage

This section presents and discusses a simplified version of the conventional search model by Stiglitz (1985). According to the basic assumptions, the workers are continually searching for a higher paid job. Companies are assumed to pay the fixed training costs $T$ for each entrant when they are entering the company. The interest rate for the training costs is denoted by $r$. The workers quit when they find a better paid job. The workers leave the ranks of the workers at the rate of $q(w)$. The quit function $q$ is assumed to depend on the present wage of the worker $w$. The workers are replaced by an equal number of new workers. The quit function acts like the depreciation factor on the human capital of the company.

The production is characterized by the training costs, which are creating a flow of output per worker $f(T)$. The constant returns-to-scale property of the technology is assumed. The
wage is the only decision variable. It is chosen to maximize the profits of the company, which can be written as follows
\[ P = f(T) - w - [q(w) + r]T. \]
Since the free entry and constant returns-to-scale property of the technology is assumed, the zero-profit condition of companies is natural. Technically, it is obtained by setting \( P = 0 \) in Eq. (1). The zero-profit condition is, however, a simplification, which can be relaxed if deemed necessary. As an implication, the market-clearing wage can be written as being equal to the production minus the training costs term. Clearly, the wage is an increasing function of the production and a decreasing function of the quit rate and interest rate.

Implicitly, the model describes the dynamic process of labour turnover. Let us assume that employed workers are identical and have the same search parameters. If for some exogenous reason the productivity of the workers decreases, their wage level will also decrease sooner or later. The reason for declining worker productivity may be a negative technological progress or a negative shock on the demand for the good produced by the company under consideration. In practice, the decrease of wages takes place in terms of real wages. The worker does not get any raise in an inflation economy.

As a consequence of the wage dispersion due to exogenous reasons, the low-wage group will have a higher probability of leaving the company. The workers sort themselves between employment and other states of labour market. The model gives a prediction that low-wage workers would enter unemployment or nonparticipation through quitting a job and leaving the industry. In addition, one could expect that the low-wage workers would seek better paid jobs and the job-to-job transitions would tend to be followed by higher wages.

The quit rate function is assumed to be a decreasing convex function. Stiglitz (1985) gives arguments why the quit rate function should have the given shape. In order to analyze the effect of the training costs, let the subscripts denote the derivatives. Then the implicit-function rule of differentiation gives (Eq. (2)):
\[ q_w(w) = -1/T. \]

The quit rate is a convex decreasing function. The tangency of the quit rate function with the straight iso-cost curve with slope \(-1/T\) gives the optimal wage.

The reasons for quitting a company can be classified into two categories. The workers quit the labour force or become voluntarily unemployed with probability \( \mu(w) \) or alternatively, they find better paid jobs. It is assumed that \( \partial \mu/\partial w > 0 \). For some workers, an intervening spell of unemployment is observed immediately after they quit their job. For others, consecutive employment is observed, since they quit their job in order to accept immediately a new one.
The probability of changing jobs depends on the number of searches during the search period \( s \) and on the unknown wage offers. Wage offers are characterized by the distribution function \( F(w) \). The quit rate function can be written as follows:

\[
q(w) = \mu(w) + s[1 - F(w)].
\]  

The probability that a worker finds a higher paid job is a product of the search activity \( s \) and the probability of finding an acceptable offer \( 1 - F(w) \). According to Eq. (4), the workers leave the ranks of the workers exponentially at the rate of \( q(w) \). The exponential distribution implies that a worker’s expected tenure is \( E(t) = 1/q(w) \), where \( q(w) \) is the quit rate during each period.

Job mobility induces expenditures on training for the recruiting companies. The optimal level of wages depends on the training costs. Lowering the relative wage of workers increases the quit rate. Therefore, companies may be reluctant to lower the wage. Even though the workers are willing to work for less, they may consider it a temporary phase as they begin more actively to search for a new job.

Imperfect information on wages means that the companies can exploit the workers by using for some degree their monopoly power. They can keep the workers some time even though they pay less than the market-clearing wage. Sooner or later, the companies, however, lose the low paid workers to other companies. To some extent, wage differentials reflect the exercise of monopoly power of companies.

3. Description of the data on job tenure

The study is based on data from the administrative files of the Confederation of Finnish Industry and Employers (TT). The data have been reported and analyzed in various other studies (e.g. Kettunen, 1993, 1998). This study extends the previous investigation by analyzing the longitudinal data on the job tenure in Finnish industry.

The sample is based on the outflow of workers from employment. The files enable the researcher to document labour-market states occupied by individuals. The data are representative of the manufacturing industry, because about 80% of the Finnish industrial workers are working in the member companies of TT. The wage information is collected every quarter from all the blue-collar workers in the member companies.

The data are reliable, because they are obtained directly from the accounting figures of the companies. The number of workers is about 300,000 every quarter. The data have been primarily collected for the wage negotiations on the central and union levels. Also quarterly aggregate statistics are published using the data.

The sampling of spells of employment was made from the outflow of workers from the companies. The flow data generally lead to different kinds of models than the stock data as shown by Chesher and Lancaster (1983). About 55,000 persons left the member companies during 1990. In order to guarantee the random and seasonally representative sample, the workers were sorted into a random order and every 15th worker was picked from the outflow during 1990. This sample contains 3703 individuals who have experienced a transition from a job during 1990.
The workers in the three largest industries of the metal and forest industries were included in the final sample. The forest industry includes the wood and paper industry. A reason for selecting these industries is that the number of wage groups defined in the collective wage agreements is different between the industries. Some of the industries have too few observations in order to draw reasonable statistical conclusions about the effects of the wage groups. The selection of the three industries leaves 2929 workers in the sample.

Some of the workers in the sample have unbelievably high wages. These kinds of cases can occur if the workers have been working during a quarter only a few hours and have got some parts of their earnings afterwards or in advance. The observations where the wage level exceeded FIM 110 were rejected. There were 30 excluded outliers. The final sample includes 2899 observations.

There are two kinds of transitions among the persons who left the companies. It can be observed from the data whether the workers immediately find another job in Finnish industry. Alternative forms of exit from a job may include transitions into unemployment and nonparticipation. These alternative forms of exit may include also workers who quit a job in the shrinking manufacturing industry and directly enter a new job in the expanding service industries. Unfortunately, we do not have information on the destinations of the persons who have left the industry.

Every worker was followed backwards until they became employed in that particular company. In this study, we analyze the single spells of employment for each individual. The job tenure is considered to start if the worker has not obtained any income during the previous quarter. The follow-up went back to the year 1980. So the longest observed lengths of employment were 11 years in the sample.

About 14% of the workers were working during the first quarter of 1980. It cannot be known if the workers were unemployed or employed in other companies in 1979. These workers were lost in the follow-up, because it would have been too expensive to go through hundreds of thousands of observations in order to get additional information for a few hundred workers. These observations are called censored, since the beginning of the employment is not known to the researcher. The censoring is rather mild, but it has to be taken into account in econometric studies. Access to the reliable information on wages recording the sequence of actual wage payments throughout a spell of employment is a substantial advantage of this study.

The dates of entry into and exit from a job is not known. Therefore, the job tenure is calculated using the number of quarters during which the persons have been working. One could suspect whether the job tenure is accurately measured. There are, however, 11 years in the follow-up. That implies 44 different lengths of employment. It has been shown that the parameter estimates of transition models are not generally very sensitive to time aggregation in simple parametric or semiparametric cases (see Bergström & Edin, 1992). So it can be argued that there is enough variation in the variable of interest.

Table 1 presents the descriptive statistics of the data. The workers who find new jobs within the industry have been working in the company on average 3.9 years, while the persons who do not find new jobs within the industry have 2.5 years of experience in their jobs. Because 14% of the observations are censored, these figures do not represent the true
job tenures. The notable difference in the job tenures supports the reasoning that job
experience is related to the probability of finding new jobs within the industry.

Those who move from one job to the next within the industry are called movers.
According to the descriptive statistics, men are slightly overrepresented by the movers. Also,
the share of men is higher in the companies which the workers leave in order to get a job in
the industry. The persons who leave the industry are called the leavers. The movers are nearly
2 years older than the leavers. The average age of men in the company is slightly higher for
the workers who relocate to other industrial companies. Women are older than men. The
average age of men is 37.2 years in the whole sample whereas the average age of women is
41.3 years. Some companies have only male workers.

Table 1
Means of the data on job tenure

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Job tenure, years</td>
<td>3.35</td>
<td>3.92</td>
<td>2.54</td>
</tr>
<tr>
<td>Sex, 1 = male</td>
<td>0.79</td>
<td>0.82</td>
<td>0.76</td>
</tr>
<tr>
<td>Share of men, %</td>
<td>79.87</td>
<td>81.21</td>
<td>77.97</td>
</tr>
<tr>
<td>Age, years</td>
<td>33.10</td>
<td>33.83</td>
<td>32.07</td>
</tr>
<tr>
<td>Average age of men in a company</td>
<td>37.17</td>
<td>37.44</td>
<td>36.78</td>
</tr>
<tr>
<td>Average age in a company</td>
<td>38.04</td>
<td>38.22</td>
<td>37.79</td>
</tr>
<tr>
<td>High cost area, 1 = yes</td>
<td>0.33</td>
<td>0.35</td>
<td>0.31</td>
</tr>
<tr>
<td>County of Uusimaa, 1 = yes</td>
<td>0.16</td>
<td>0.14</td>
<td>0.19</td>
</tr>
<tr>
<td>Share of incentive work hours\a, %</td>
<td>22.09</td>
<td>23.86</td>
<td>19.57</td>
</tr>
<tr>
<td>Share of incentive work hours\b, %</td>
<td>27.69</td>
<td>27.26</td>
<td>28.30</td>
</tr>
<tr>
<td>Share of overtime hours, %</td>
<td>3.71</td>
<td>3.67</td>
<td>3.77</td>
</tr>
<tr>
<td>Share of Sunday hours, %</td>
<td>4.44</td>
<td>4.70</td>
<td>4.07</td>
</tr>
<tr>
<td>Quarter, 1 = yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.20</td>
<td>0.20</td>
<td>0.21</td>
</tr>
<tr>
<td>2</td>
<td>0.15</td>
<td>0.12</td>
<td>0.19</td>
</tr>
<tr>
<td>3</td>
<td>0.29</td>
<td>0.21</td>
<td>0.42</td>
</tr>
<tr>
<td>4</td>
<td>0.35</td>
<td>0.47</td>
<td>0.18</td>
</tr>
<tr>
<td>Wage group, metal, 1 = yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.18</td>
<td>0.20</td>
<td>0.15</td>
</tr>
<tr>
<td>2</td>
<td>0.27</td>
<td>0.27</td>
<td>0.25</td>
</tr>
<tr>
<td>3 (low)</td>
<td>0.12</td>
<td>0.09</td>
<td>0.16</td>
</tr>
<tr>
<td>Wage group, forest, 1 = yes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>0.10</td>
<td>0.08</td>
<td>0.12</td>
</tr>
<tr>
<td>2</td>
<td>0.10</td>
<td>0.10</td>
<td>0.11</td>
</tr>
<tr>
<td>3</td>
<td>0.11</td>
<td>0.11</td>
<td>0.11</td>
</tr>
<tr>
<td>4</td>
<td>0.07</td>
<td>0.08</td>
<td>0.05</td>
</tr>
<tr>
<td>5 (high)</td>
<td>0.06</td>
<td>0.07</td>
<td>0.05</td>
</tr>
<tr>
<td>Relative regular wage in a company</td>
<td>0.95</td>
<td>0.96</td>
<td>0.93</td>
</tr>
<tr>
<td>Relative total wage in a company</td>
<td>0.95</td>
<td>0.96</td>
<td>0.92</td>
</tr>
</tbody>
</table>

The number of observations 2899 1707 1192

A = the whole sample; B = the workers who find new jobs in the industry; C = the workers who do not find new jobs in the industry.

\a The incentive wage based on quantity.

\b The incentive wage based on quality and quantity.
The high-cost areas of Finland have been designated by the government. The areas include the largest towns, islands, and Lapland. According to the collective wage agreements, higher wages have to be paid in the high cost area. There are no remarkable differences in the high- and low-cost areas between the movers and leavers. Neither are there remarkable differences in the county of Uusimaa and the rest of the country.

The earnings and working hours have been decomposed into three methods of pay in the data. About half of the working hours are paid at the time-based wage in manufacturing. The remaining incentive wages have been decomposed into two groups. One group comprises the work based on the quantity of the output. The other group encompasses incentive wages based also on the quality of the output.

The share of incentive work hours based on quantity is slightly higher in the companies where the persons leave in order to get a job from the industry. This may indicate the strenuous nature of piece-rate work, because tired workers may search for another job. The shares of incentive work hours based on quality and quantity are not different for the two destinations. The shares of overtime and Sunday hours are not very different between the movers and leavers. Both the share of overtime and Sunday work are on average around 4–5% of all the working hours in a company.

The means of the quarterly indicators show that the job-to-job movers change jobs most often during the last quarter of the year (47% of the movers). On the other hand, the persons who leave their industrial jobs leave most often during the third quarter (42% of the leavers). This conclusion is in great measure due to the annual holidays and considerable variation in the Finnish climate. The persons who are filling summer-time jobs or holiday vacancies enter unemployment, nonparticipation, or another job outside the industry.

The wage groups represent the organizational level of the workers and they are defined in the collective wage agreements according the required levels of skill in the job. There are three wage groups in the metal industry and five groups in the wood and paper industries. Most workers of the sample are on the middle levels of the wage groups both in the metal and forest industry. More often, the persons on the highest levels of the wage groups move to the other industrial companies and the workers on the lowest levels leave the industry. This characteristic of the data is more outstanding in the metal industry than in the forest industry. These findings support the reasoning that those moving from one job to the next in the industry are often skilled workers.

The average relative wages of workers have been calculated in relation to the average wage of the company in 1990. The relative wage in the company is therefore a relative termination wage of a worker in a company. There are two wage concepts in the data. The regular wage includes only the earnings based on the ordinary hours of work. The total wage includes also the wage incrementals based on the overtime and Sunday work. The relative total wage of the movers in the company is 0.96 whereas the corresponding wage for the leavers is 0.92.

These simple descriptive statistics of the data support the argument that wage differences between the workers in a company create incentives for the workers to leave their employer. The results are in accordance with the prediction of the simple model of on-the-job search. Low-wage workers enter unemployment often by quitting their jobs and leaving the industry.
4. Econometric models of job tenure

4.1. Competing risk models

The econometric approach of this study is to estimate models of job tenure. The models are used to identify the personal, job, and labour-market characteristics that are related to the probabilities of finding another industrial job and leaving the industry. The fact that there are alternative channels out from a company is explicitly accounted for. A two-alternative competing risk model with censoring is an obvious candidate for analyzing the problem.

In a competing risk framework, the destinations are assumed to be mutually exclusive and to exhaust the possible destinations. Let \( d_j \) be an indicator taking the value 1 if state \( j \) is entered and 0 otherwise. For a random variable \( T \) representing the waiting time until a particular event takes place the hazard function of a destination \( j \) can be written as follows (Eq. (5)):

\[
h_j(t) = \lim_{dt \to 0} \Pr(t \leq T \leq t + dt, d_j = 1 | T > t)/dt = f_j(t)/S(t),
\]

where \( f_j(t) \) and \( S(t) \) are the density and survivor functions. The transition intensities, \( h_j(t) \), \( j = 1, \ldots, J \), represent instantaneous rates for the worker leaving the company to enter state \( j \) during a small interval \( (t + dt) \) given that the person is still working in the company. In a small interval, the probability of the departure to state \( j \) is expressed by \( h_j(t)dt \).

The cause-specific hazard functions related to the distinct destinations define the total hazard functions for job tenure as follows (Eq. (6)):

\[
h(t) = \sum_{j=1}^{J} h_j(t).
\]

The total hazard function is of relevance towards writing the integrated hazard (Eq. (7)):

\[
I(t) = \int_0^t h(\tau)d\tau = \int_0^t \sum_{j=1}^{J} h_j(\tau)d\tau = \sum_{j=1}^{J} I_j(t).
\]

The survivor function can then be written as follows (Eq. (8)):

\[
S(t) = e^{-I(t)}.
\]

\( S(t) \) is the probability that the person is still working in a company. Then the probability of exiting to destination \( j \), the density function, can be written as follows (Eq. (9)):

\[
f_j(t) = h_j(t)S(t).
\]

A complete or censored duration of employment is observed. Let \( c \) be a censoring indicator. If \( c = 1 \), then a complete spell of employment is observed, otherwise \( c = 0 \). The contribution of an individual to the likelihood function for a complete spell can be expressed using the density function. In the case of censoring, the contribution comes via the probability that the duration was at least \( t \) units of time. The probability is
expressed using the survivor function. The likelihood function can then be written as follows (Eq. (10)):

\[ L(\theta) = \prod_{n=1}^N \prod_{j=1}^J h_j(t)^{c_{dj}} S(t), \]  

where \( N \) is the size of the sample.

In order to solve the maximum likelihood estimates of the unknown parameters, the sum of individual log-likelihood components is maximized with respect to the parameters. The log-likelihood contribution of an individual \( n \) for a failure type \( j \) can be written as follows:

\[ \log L_n(\theta) = c_{dj} \log h_j(t) - I(t) = c_{dj} \log h_j(t) - I_j(t) - \sum_{k \neq j} I_k(t). \]  

The examination of Eq. (11) leads to a substantial advantage in estimating the model. It turns out that the log-likelihood contribution can be partitioned into separate terms of cause-specific terms (see also Kalbfleisch & Prentice, 1980, pp. 168–171). Therefore, the parameters of a particular cause-specific hazard can be estimated separately by treating each time the durations terminated by other reasons as censored. So far the log-likelihood function (11) of job tenure has been written in a general form. The distribution of job tenure needs to be parametrized in order to estimate the model.

4.2. Discrete mixing distribution

In this section, the econometric model of job tenure is studied. Special attention is paid to the effects of unobserved heterogeneity across workers. The mass point approach to the incorporation of the effects of unobserved explanatory variables is applied. A standard way of incorporating unobserved heterogeneity is to assume some parametric distribution for it. The estimates of the structural parameters may, however, be sensitive to the selected parametric form of the distribution.

The procedure of discrete mixing distribution has been derived in order to minimize the impact of distributional assumptions in the econometric models of duration data. Since the earlier work by Kiefer and Wolfowitz (1956), the properties of the mixing distribution have been studied by Heckman and Singer (1984), Laird (1978), Lindsay (1983a, 1983b), and Simar (1976). Furthermore, there exists a wide set of applications. Card and Sullivan (1988), Davies (1987), Davies and Crouchley (1984), and Dunn, Reader, and Wrigley (1987) have applications in the context of discrete choice models. Brännäs (1986a, 1986b), Ham and Rea (1987), and Trussell and Richards (1985) have applied the method in the context of duration models.

The Weibull distribution has been widely used in the applications of job tenure. Assuming a parametric Weibull distribution, the mixing likelihood contribution for a destination \( j \) can be written as follows (Eq. (12)):

\[ f_Q = \sum_{i=1}^m p_i h_i(t)^e e^{-I_i(t)}, \]  

where \( h_i(t) \) is the hazard rate of the \( i \)-th group, \( p_i \) is the mixing probability, and \( e \) is the shape parameter.
where $h_i(t) = e^{u_i t} + x_i$ and $I_i(t) = e^{u_i t} + x_i$ are the hazard functions and integrated hazards for the different unobserved groups and $m$ is the number of points of support of the discrete mixing distribution $Q$. The subscript $j$ has been left out for convenience. Then the indicator $c = 1$ if a complete spell and a destination $j$ is observed, otherwise $c = 0$. The constant of the basic Weibull model is split into the parameters $u_i$ and the corresponding densities are given probabilities $p_i$. Hence, the discrete mixing distribution is consistently estimated with the structural parameters. For the probabilities $p_i$, it is required that $p_i \in (0, 1)$ and that $\sum p_i = 1$. These requirements are satisfied using a multinomial logit type of formula (Eq. (13)):

$$
p_i = \frac{e^{g_i}}{1 + \sum_{k=1}^{m-1} e^{g_k}}, \quad i = 1, \ldots, m - 1,
$$

where $g_k, k = 1, \ldots, m - 1$ are the parameters to be estimated. The logit formula implies that $p_m = 1 - p_1 - p_2 - \ldots - p_{m-1}$. The parameters $g_k$ do not have an interesting economic interpretation. They work only as a device in order to obtain the probabilities $p_i$. The standard errors of the probabilities $p_i$ are approximated by the well-known delta method. The procedure for estimating a discrete mixing distribution is to increase the number of mass points until the influence of unobserved variables disappears. The stopping rule is found by Lindsay (1983a).

Table 2 presents the results of the estimations. The estimation has been done in a competing risk framework separately to both of the destinations following the mass point approach of incorporating unobserved heterogeneity to the model. The number of observations is 2899 and the explanatory variables are the same in both of the groups. The data of the models differ only with respect to the indicators of the destinations.

Two points of support of the discrete mixing distribution are enough to rectify the effect of unobserved heterogeneity in the model for the persons who find new jobs. Unobserved heterogeneity split the observations into two groups having 42% and 58% of the observations. It is not, however, possible to identify these observations from the data set. Correspondingly, in the model of the persons who do not find new jobs, three points of support are needed. They take the probabilities of 33%, 36%, and 31%. Accordingly, this group consists of more heterogenous workers.

### 4.3. Effects of explanatory variables on the job tenure

The previous econometric models are interesting, because they indicate the statistically significant effects of explanatory variables on the job tenure. It can be argued that the study is insufficient, because it does not tell very much about the economic importance of the effects. The size of the effects is studied in this section by simulating the estimated microeconomic models. The effect of an explanatory variable can be statistically significant even though the effect is small and therefore, economically unimportant. The economic importance of the explanatory variables is illustrated for an average person in the industry.
For the illustration, the expected value of a job duration has to be derived. The survivor function is obtained from the mixing likelihood contribution by setting \( c = 0 \). It can be written as follows (Eq. (14)): 

\[
S(t) = \sum_{i=1}^{m} p_i e^{-I_i(t)}. 
\]

Thus, the expected value of the job tenure can be written as follows (Eq. (15)): 

\[
E(T) = \int_0^\infty \sum_{i=1}^{m} p_i e^{-\alpha(x_i^3+x_i^2)} dt = \sum_{i=1}^{m} p_i \frac{e^{-(\alpha x_i^3)/\alpha}}{\Gamma(1/\alpha)} \frac{\Gamma(1/\alpha)}{\alpha}, 
\]
where $\Gamma$ is the gamma function and the integration is done by a change of variables letting $I_i = \int e^{x_i} \, dx_i$.

Table 3 presents the effects of the changes of the explanatory variables on the job tenure. The characteristics of the workers are fixed at the average values. Thereafter, the effect of each explanatory variable on the job tenure is studied by giving it different values as shown in Table 3.

Ten additional years of age increase the job tenure by 3.7 years among the persons who leave the industry and 4.6 years among the persons who find new industrial jobs. If the average age of workers in a company increases by 10 years, the increase of job tenure is 4–5 years. The average age of men has a negative effect. Therefore, if the average age of women increases in a company, the expected job tenure is long. In the county of Uusimaa, the exit from the industry occurs 3 years earlier than in the other parts of the country. In Uusimaa, there are usually plenty of vacancies available, because the economic development is favourable.

<table>
<thead>
<tr>
<th>The change of the explanatory variable</th>
<th>The change of the expected duration of employment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender: female $\rightarrow$ male</td>
<td>$-0.3$ $-0.4$</td>
</tr>
<tr>
<td>Share of men: $0.5$ $\rightarrow$ $1.0$</td>
<td>$-0.1$ $0.2$</td>
</tr>
<tr>
<td>Age: $30$ $\rightarrow$ $40$ years</td>
<td>$3.7^<em>$ $4.6^</em>$</td>
</tr>
<tr>
<td>Average age of men: $30$ $\rightarrow$ $40$ years</td>
<td>$-5.6^*$ $-2.6$</td>
</tr>
<tr>
<td>Average age: $30$ $\rightarrow$ $40$ years</td>
<td>$5.1^*$ $5.2$</td>
</tr>
<tr>
<td>High cost area: no $\rightarrow$ yes</td>
<td>$-0.8^<em>$ $1.5^</em>$</td>
</tr>
<tr>
<td>County of Uusimaa: no $\rightarrow$ yes</td>
<td>$-0.2$ $-3.0^*$</td>
</tr>
<tr>
<td>Share of incentive hours $^a$: $0.2$ $\rightarrow$ $0.8$</td>
<td>$-0.5$ $2.4^*$</td>
</tr>
<tr>
<td>Share of incentive hours $^b$: $0.2$ $\rightarrow$ $0.8$</td>
<td>$-0.4^*$ $1.4$</td>
</tr>
<tr>
<td>Share of overtime hours: $0.02$ $\rightarrow$ $0.10$</td>
<td>$-2.2^<em>$ $-3.8^</em>$</td>
</tr>
<tr>
<td>Share of Sunday hours: $0.02$ $\rightarrow$ $0.10$</td>
<td>$-0.2$ $3.4^*$</td>
</tr>
<tr>
<td>Quarter: $1$ $\rightarrow$ $2$</td>
<td>$1.1^<em>$ $-2.1^</em>$</td>
</tr>
<tr>
<td>Quarter: $1$ $\rightarrow$ $3$</td>
<td>$-0.4$ $-4.1^*$</td>
</tr>
<tr>
<td>Quarter: $1$ $\rightarrow$ $4$</td>
<td>$0.2$ $15.2^*$</td>
</tr>
<tr>
<td>Wage group 3 (metal) $\rightarrow$ $2$ (metal)</td>
<td>$0.4^<em>$ $2.1^</em>$</td>
</tr>
<tr>
<td>Wage group 3 (metal) $\rightarrow$ $1$ (metal)</td>
<td>$0.9$ $3.3^*$</td>
</tr>
<tr>
<td>Wage group 3 (metal) $\rightarrow$ $1$ (forest)</td>
<td>$-0.1$ $-0.3$</td>
</tr>
<tr>
<td>Wage group 3 (metal) $\rightarrow$ $2$ (forest)</td>
<td>$0.4$ $0.6$</td>
</tr>
<tr>
<td>Wage group 3 (metal) $\rightarrow$ $3$ (forest)</td>
<td>$2.3^*$ $1.7$</td>
</tr>
<tr>
<td>Wage group 3 (metal) $\rightarrow$ $4$ (forest)</td>
<td>$5.0^<em>$ $9.0^</em>$</td>
</tr>
<tr>
<td>Wage group 3 (metal) $\rightarrow$ $5$ (forest)</td>
<td>$7.0^<em>$ $11.3^</em>$</td>
</tr>
<tr>
<td>Relative wage</td>
<td></td>
</tr>
<tr>
<td>1.0 $\rightarrow$ $0.8$</td>
<td>$-0.2^<em>$ $-2.1^</em>$</td>
</tr>
<tr>
<td>1.0 $\rightarrow$ $1.2$</td>
<td>$0.2^<em>$ $2.7^</em>$</td>
</tr>
</tbody>
</table>

$^a$ The incentive wage based on quantity (%).

$^b$ The incentive wage based on quality and quantity (%).

* Statistically significant coefficient on the 5% level.
The incentive work increases the job tenure by 2–4 years among the persons who leave the industry compared to the workers on the time-based wage. The incentive wage is usually higher than the time-based wage. This is in accordance with the wage effect, because a high wage usually increases the job tenure.

The share of overtime work decreases the job tenure in both of the destinations. The effect can easily be many years. Overtime work may cause problems in children’s day care. Young children decrease the willingness to participate in overtime work. The Sunday work can easily increase the job tenure by many years among the persons who leave the industry. In Finland, the wage incrementals based on Sunday work are substantial. That is in accordance with the wage effect.

The seasonal variation is notable among the persons who leave industrial jobs. There are plenty of short employment spells, which terminate during the second and third quarter of the year. The job tenures that terminate during the second quarter are 2.1 years shorter than the job tenures that terminate during the first quarter. Correspondingly, in the third quarter, the job tenures are 4.1 years shorter whereas in the forth quarter, the job tenures are extremely long.

Each higher level of wage group increases the job tenure. In the metal industry, the increase from the lowest level to the middle level increases the job tenure 2.1 years and the increase from the lowest level to the highest level increases the job tenure 3.3 years among the persons who leave the industry.

In the forest industry, each higher level of wage group increases the job tenure so that in the highest wage group, the job tenure is 7.1 years longer than in the lowest wage group among the workers who change their jobs in the industry. The corresponding effect is 11.6 years among the persons who leave industrial jobs.

The relative wage within a company has a negative and statistically significant effect on the exit rate in both of the destinations. The effect of the wages for those moving from one job to the next in the industry is rather small compared to the other destination. The small value of the coefficient can to some extent reflect the positive effect caused by the employer who tries to keep these workers in a company by offering an increasing wage profile. The relative wage in the company has a notable economic importance only among the workers who leave the industry. The effects of wages on the job tenure are not linear. For example, a decrease of wages by 20% will decrease the expected value of job tenure by 2.1 years. The increase of wages by 20% increases the job tenure by 2.7 years.

5. Conclusions

In the data, there are two kinds of transitions among the persons who left the companies. The workers can immediately find another job within the industry or they may leave the industry. About 59% of the workers found another industrial job and 41% of workers left the industry. The relative wage level is lower for the persons who leave the industry. This gives support to the search models. For the low-wage workers, the opportunity cost of unemployment and nonparticipation is low. Therefore, the low-wage workers are expected to leave the industry.
The models of job tenure were estimated in a competing risk framework. According to the
results of estimations, the required level of skill, which is the wage group of the collective
wage agreements, is negatively related to the exit rate. The coefficients of the indicators are
similar in both of the destinations. The turnover of workers is higher in the jobs which have
low requirements. This remark supports the argument that highly skilled labour cannot be
replaced easily and therefore they are better paid.

The relative wage of the worker with respect to the wage level in the company is
negatively related to the exit rate. Wage differences are reasons for workers to search for
better paid jobs. The results support the conclusion that the low relative wage within the
company spurs workers to search for better paid jobs. The negative relationship of the wages
is larger for the persons who leave the industry.

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