# Returning long-term Sick-Listed to Work

## The Effects of Training in a Competing Risk Model with Time Varying Covariates and Unobserved Heterogeneity

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## The Study

The Danish policy towards work-disabled persons seems to comprise contradictory forces. On the one hand, the state seeks to enhance labour market integration of work-disabled persons through vocational rehabilitation. On the other hand, lax job protection legislation makes it easy for employers to dismiss sick-listed employees. This paper assesses simultaneously the effect of these two policy aspects. In contrast to previous studies, we distinguish between returning to work with the old employer and a new employer. The analyses are based on a five-year panel data set with 433 long-term sick-listed employees. Using a competing risk model with random effects, we find that the process of returning to work with the old employer in certain respects is different from the process of returning to work with a new employer. Furthermore, we find that separation has only limited direct effect on returning to work, but it effectively separates employees with low and high employability. Participation in educational measures seems not significantly to help the sick-listed back to work. We conclude therefore that the Danish policy through its lax job protection legislation facilitates a flexible labour market, but an important drawback seems to be that many sick-listed employees loose their labour market attachment.

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# 1. Introduction

The Danish policy towards long-term sick-listed employees seems to comprise contradictory forces. Vocational rehabilitation measures may enhance reintegration, whereas a limited employer responsibility may reduce it. It is the aim of this paper to assess the effect of these two policy aspects by estimating simultaneously the effects of separations and educational measures on the return to work of long-term sick-listed employees.

It is a public responsibility to provide temporary economic compensation to employees who report sick. In case of lasting work incapacity, it is also a public matter to monitor all cases of sick leave and provide necessary medical and vocational assistance to help the sick-listed employees back into ordinary employment. Vocational rehabilitation appears to be applied quite frequently. In a six-nation comparison Bergendorff & Gordon (2001) find that long-term sick-listed employees in Denmark relatively often participate in activities such as job training, vocational education and general education.

While the public sector plays a major role in the labour market integration of persons with health problems, employers' responsibility is limited. Employers do neither contribute to the financing of cash benefits (except for the first two weeks of a sick leave) or vocational rehabilitation services. Also, employers' participation in vocational rehabilitation and other reintegration measures is voluntary, i.e. rather than forcing employers to participate, reintegration is supported by publicly financed subsidies. In addition, the Danish job protection legislation makes it relatively easy for employers to dismiss employees during a sick leave. The limited responsibility implies that employers' costs of laying off sick-listed employees are low. This appears in part to account for the high number of dismissals among long-term sick-listed employees, which in turn seems to reduce the labour market attachment of long-term sick-listed employees (Høgelund, forthcoming).

Apparently only few studies have assessed how separations and vocational rehabilitation in terms of educational measures affect how long-term sick-listed fare in the labour market.[1] In a comparative six-nation study of long-term sick-listed employees with low-back diagnoses, Veerman & Palmer (2001) find that education and job training in general has no effect on work status and in the case of Denmark the effect is negative. Høgelund (2000) used a subset of this data of 810 Dutch and Danish employees. With a Cox proportional duration model, he finds that general education has no effect on the probability

[1] Here we limit ourselves to studies of employees on sick leave meaning that many (mainly cost-benefit) studies of vocational rehabilitation of disability benefit and workers' compensation beneficiaries are disregarded cf. Berkowitz et al. (1988).

of work resumption, while test of work capacity has a positive effect in the Danish data. The study of Bergendorff et al. (1997) that covers about 60,000 persons sick-listed for 60 days or more suggests that vocational rehabilitation (including educational measures) has a negative effect on the probability of reporting fit for work. This is however not supported by Heshmati & Engström (2001) who used a non-representative subset on 8,839 persons of the same data as Bergendorff et al. (1997). Heshmati & Engström (2001) find that vocational rehabilitation has a positive effect returning to work. In contrast to the above mentioned studies, they simultaneously estimate the probability of participation in vocational rehabilitation and the probability of returning to work allowing for unobserved heterogeneity. Also using a subset on 6,287 persons of the data used in Bergendorff et al. (1997), Frölich, Heshmati & Lechner (2000) apply a matching technique in order to estimate the effects of different types of vocational rehabilitation. The findings suggest that workplace rehabilitation is most effective in bringing the sick back to work, while educational measures seem to have a quite strong and negative impact.

In their six-nation study of long-term sick-listed employees, Veerman & Palmer (2001) find that job separation influences work status one year after the first day of sick leave in Denmark, Germany and the US, whereas it apparently has no effect in the Netherlands, Sweden and Israel. The results of Høgelund (fortcoming) suggest that the institutional settings concerning job protection legislation affect the labour market attachment of long-term sick-listed employees. Using a simple logit model on the before mentioned data of Dutch and Danish long-term sick employees, he finds that the Dutch job protection legislation, which is much more strict than the Danish legislation, limits how often employers dismiss the employees. Moreover, a survival analysis suggests that dismissal has a strong and negative effect on the probability of returning to work.

In sum, previous studies provide mixed evidence about the effect of vocational rehabilitation. Agreement however exists that educational measures do not increase the labour market attachment of long-term sick-listed employees, whereas dismissals have a negative effect. In contrast to previous return to work studies[2], in this paper we distinguish between returning to work with the old employer, i.e. the same employer as prior to becoming sick, and with a new employer. We also allow for the effect of unobservable covariates through random effects. Distinguishing between returning to the old and a new employer, we find that separation has only limited direct effect on returning to work, but it effectively separates employees with low and high employability. It also turns out

[2]For a review of the return to work literature, see e.g. Høgelund (2001) and Krause & Lund (forthcoming).

that educational measures only influence return to work with a new employer and that the net effect is insignificant. This is because negative locking-in effects almost cancel the positive effects of completing the measures.

The paper is organised as follows. First, in section 2, the Danish disability policy is described. This is followed by a description of the data and the anticipated effects of the covariates in section 3 and section 4, respectively. Then the econometric model is specified in section 5 and the results of the estimations are presented in section 6. The paper is concluded by a discussion in section 7.

## 2. The Danish disability policy

The Danish social policy is characterised by a one-string system: local public authorities (municipalities) are responsible for the alleviation of the citizens' social problems (Andersen, 1971). The public sickness benefit scheme covers employed, unemployed and self-employed persons. The scheme provides full wage compensation up to a ceiling that is equal to the maximum unemployment benefit. Benefits, which normally can be received for up to 52 weeks within a period of 18 months, are financed by employers' for the first two weeks and by public funds for the remaining period.[3]

The municipality is obliged to follow-up all cases of sickness benefit within two months after the first day of work incapacity and thereafter at least every second month. The municipality should assess the need for medical treatment and vocational rehabilitation in order to retain the sick-listed's attachment to the labour market. This is supposed to happen in cooperation between the municipalities' case-manager, the sick-listed employee, and actors such as the employer, medical experts, the public labour exchange services and vocational rehabilitation institutions. Vocational rehabilitation measures range from secondary school classes, courses and test of work capacity in a work-like environment to wage subsidised job training and tertiary education at the university level. During vocational rehabilitation, which cannot normally last longer than five years, the sick-listed person is entitled to a vocational rehabilitation benefit of the same amount as the sickness benefit.

If medical treatment and vocational rehabilitation is insufficient to bring the sick-listed employee back into ordinary employment, he or she may be referred to a wage subsidised

[3] When the data used in the present study was collected employers in the public sector were obliged to finance sickness benefits during the complete sickness spell.

job on special conditions, e.g. fewer hours and less demanding tasks. When this is impossible because the person's work capacity is too limited a disability benefit may be considered. Permanently disabled people are covered by the public disability benefit scheme with entitlement depending on earnings capacity, which should be reduced with at least 50 percent. The flat rate benefits are publicly financed (by the state and municipalities), and decisions about awards rest with municipalities.

Although it increasingly is being recognised that employers play an important role for the (re-) integration of disability people, the responsibility of employers' remains restricted (Høgelund, forthcoming). In addition to the limited financial responsibility noted above, employers are obliged neither to hire persons with reduced work capacity nor to participate in vocational rehabilitation measures. What is more, lax job protection legislation makes it quite easy for employers to dismiss an employee during a sick leave. Stipulations in the White Collar act (funktionærloven) allow employers to dismiss white-collar employees with a one month notice after 120 days of sick leave within a year (though collective agreements the 120-days rule has been suspended in the public sector since 1999). The job protection of blue-collar employees is determined in various collective agreements meaning that job protection varies across branches. Many blue-collar employees are however covered by a central collective agreement making it illegal to dismiss an employee within the first 120 days of sick leave. After 120 days dismissal can take place with a normal notice, which is depending on seniority.

In sum, while the Danish policy emphasises a public responsibility for the reintegration of sick-listed employees both in terms of funding of benefits and efforts to help the sick-listed back to work, the responsibility of employers is limited. This could suggest that the Danish policy at the same time facilitates labour market flexibility and labour market integration.

## 3. The data

While most previous studies are based on relatively short observation periods, we use a five-year panel data of 433 long-term sick-listed employees, which enables us better to measure the effects of long lasting educational measures. The sample consists of information about employees who in the fourth quarter of 1995 had been continuously sick-listed for 90-120 days, were sick-listed due to low back pain, fully work incapacitated, and between 18 and 55 years. The sample was draw from 24 of the largest municipalities in Denmark.

Data has been collected four times: approximately $5\frac{1}{2}$ months after the first day of work incapacity (Wave 1), 13 months (Wave 2), 25 months (Wave 3) and 56 months after the first day of work incapacity (Wave 4). 604 employees were approached for participation at Wave 1 and interview was obtained with 514 corresponding to a response rate of 87 percent. 445 persons participated in Wave 2 meaning that 13 percent of the respondents were lost between Wave 1 and Wave 2. These 445 persons, excluding 12 persons with missing information on the dependent variables and covariates, leaving 433 persons, constitute the sample used in the analyses.

The dependent variables are defined as time to first returning to work with the old employer and time to first returning to work with a new employer, respectively. To our knowledge the distinction between old and new employer has not been applied in previous return to work studies (for a review, see Høgelund, 2001; Krause & Lund, forthcoming), but the findings in this paper suggest that it is a fruitful approach. In our context work comprises ordinary employment without public wage subsidies. Of the 240 persons who returned to work 41.3 percent returned to work with their old employer after in average 10.8 months of unemployment and 58.7 percent returned to work with a new employer after in average 21.5 months of unemployment.

As part of vocational rehabilitation the municipality may, in cooperation with the sick-listed employee, refer the sick-listed to educational measures. 141 persons participated in education during their sick leave. In average they started education 16.8 months after the first day of work incapacity and ended it 9 months later.

73 percent of the respondents were separated from their old employer during their sick leave. Of these 315 persons, 84 percent were dismissed after in average 5.1 months, while 16 percent quitted themselves after in average 5.0 months. In order to limit the number of parameters that has to be estimated, we do not distinguish between dismissals and quits (hereafter called separations).

Table 1 shows mean, standard error, and quintiles of the covariates and dependent variables that are used in the estimation of the econometric model.

**Table 1. Mean, std. err. and quintiles for covariates and dependent variables.**

| | Mean | Std. err. | 10 pct. quintile | 90 pct. quintile |
|---|---|---|---|---|
| Sex (Female=1) | 0.573 | 0 | 0 | 1 |
| Age | 39,139 | 0.456 | 26 | 52 |
| Educational attainment: | | | | |
| Primary (Yes=1) | 0.067 | 0.012 | 0 | 1 |
| Secondary (Yes=1) | 0.741 | 0.021 | 0 | 1 |
| Tertiary (Yes=1) | 0.192 | 0.019 | 0 | 1 |
| Cohabitation status | | | | |
| (Living together with a spouse=1) | 0.734 | 0.021 | 0 | 1 |
| Seniority (months) | 81.585 | 4.271 | 3.733 | 222.531 |
| Pain intensity: 1 to 10 (Much pain) | 5.610 | 0.111 | 2 | 8 |
| Ownership (Public=1) | 0.319 | 0.022 | 0 | 1 |
| Company size | 180.200 | 27.323 | 5 | 450 |
| Company size missing | 0.055 | 0.011 | 0 | 0 |
| Company history (Layoffs within | | | | |
| the last year prior to the sick leave=1) | 0.176 | 0.019 | 0 | 1 |
| Company history missing | 0.058 | 0.011 | 0 | 0 |
| Occupation: | | | | |
| Manager, professional (Yes=1) | 0.152 | 0.017 | 0 | 1 |
| Sales, service (Yes=1) | 0.462 | 0.024 | 0 | 1 |
| Craft and plant work (Yes=1) | 0.316 | 0.022 | 0 | 1 |
| Elementary work (Yes=1) | 0.069 | 0.012 | 0 | 1 |
| Compensation ratio | 0.830 | 0.009 | 0.563 | 1 |
| Compensation ratio missing | 0.039 | 0.009 | 0 | 1 |
| Spouse income ratio | 0.696 | 0.032 | 0 | 1.413 |
| Spouse income ratio missing | 0.141 | 0.017 | 0 | 1 |
| Change in regional unemployment rate, | | | | |
| t=0 to t=12 | 0.405 | 0.038 | -0.3 | 1.8 |
| Change in regional unemployment rate, | | | | |
| t=13 to t=24 | 0.347 | 0.039 | -0.400 | 1.600 |
| Change in regional unemployment rate, | | | | |
| t=25 to t=36 | 0.285 | 0.036 | -0.400 | 1.500 |
| Change in regional unemployment rate, | | | | |
| t=37 to t=48 | 0.347 | 0.035 | -0.300 | 1.600 |
| Change in regional unemployment rate, | | | | |
| t>=49 | 0.144 | 0.032 | -0.400 | 1.300 |
| Municipalities' vocational | | | | |
| rehabilitation tendency | 0.483 | 0.065 | -0.830 | 3.462 |
| Time to education, start | 16.787 | 0.995 | 6 | 35 |
| Time to education, termination | 25.730 | 1.243 | 11 | 50 |
| Separation (Yes=1) | 0.727 | 0.021 | 0 | 1 |
| Time to separation | 5.053 | 0.203 | 0 | 7 |
| Return to work for old employer | 0.229 | 0.020 | 0 | 1 |
| Time to return to work for old employer | 10.808 | 0.999 | 1 | 22 |
| Return to work for new employer | 0.326 | 0.023 | 0 | 1 |
| Time to return to work for new employer | 21.482 | 1.247 | 5 | 44 |

In figure 1a-d below we show Kaplan-Meier hazard rates for the durations in the study.

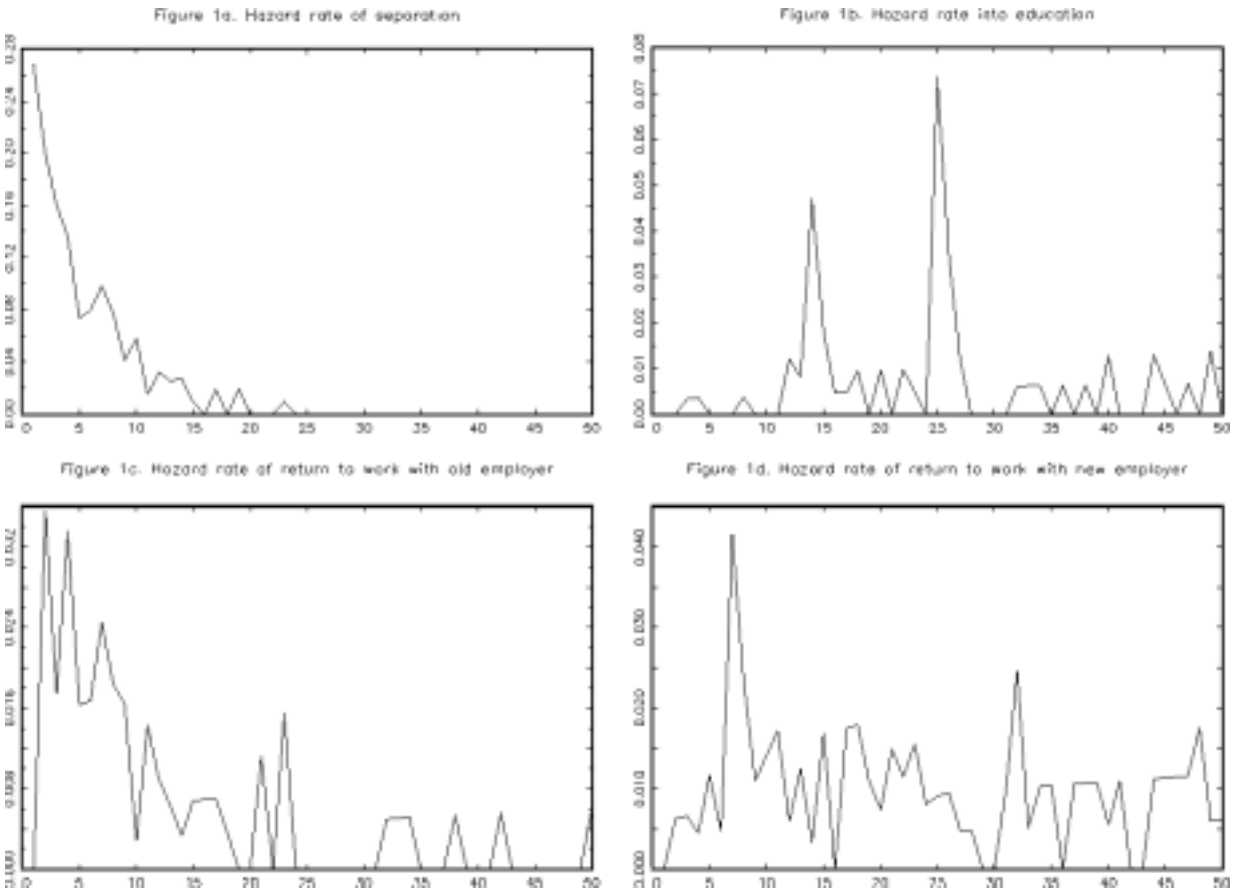


Figure 1a show the hazard rate of separation from the old employer. The shape of this hazard rate is decreasing rapidly, reflecting that most separations take place shortly after being sick-listed. The hazard rate of entering an education is shown in figure 1b. It can be seen that there are two time points where individuals are very likely to enter education, after 12 months and after 24 months. This could reflect that many educational measures only allow enrolment once or twice a year. Figure 1c shows the hazard rate of returning to the old employer. From the figure we see that the hazard rate is dropping fast during the first 12 months, and after a little more than 20 months it is virtually zero. Finally, figure 1d shows the hazard rate of returning to work with a new employer. From figure we find that during the first 12 months the hazard rate is increasing, with a notable peak at 6 months. This peak is right after the majority of separations from the old employer, see figure 1a, indicating that a large group of sick-listed find employment with a new employer after being separated from the old employer. This illustrates the importance of controlling for whether the individuals in the sample are separated from their old employer, when studying the probability of returning to work.

# 4. Some considerations on separation, education and returning to work

In this section we forward some hypotheses on the causes of separations, participation in education and on their effects on the probability of returning to work.

## 4.1. Separation

We assume that the decision about separation takes place in two steps. First, the employer decides whether the contract should be terminated. This happens through a comparison of the expected utility of continued employment with the expected utility of separation. Second, if the employer decides to continue the contract, the employee may choose to either terminate or continue the contract.

The employers' utility of continued employment is related to the employees' productivity and the expected time until the employee has regained full work capacity. Productivity, which is assumed to depend on the employees' human capital, is measured by the covariates: age, educational attainment, and seniority (see, e.g. Colbjørnsen, 1986). The latter may also reflect employers' costs of separation as employees with long seniority normally also have long notices of contract termination (e.g. Cornfield, 1982).

The sick-listed's present health condition may influence the decision of the employer through its effect on the sick-listed's productivity and the expected time until recovery. To gauge these effects we include the health measure self-rated pain intensity measured on a scale from 1 (no pain) to 10 (pain as severe as possible). Because of endogeneity, the use of health measures may be problematic, see e.g. Bound (1990). However, the results in section 6 show that the effects of pain intensity are insensitive to introduction of unobserved heterogeneity in our econometric model, suggestion that endogeneity of this variable is of little importance.

Two company characteristics are included: company size and ownership, i.e. public or private ownership. In general, large companies have more different types of jobs with different job demands than small companies meaning that large companies have better opportunities for re-employment of sick-listed employees having reduced work capacity. Consequently, the costs of continued employment of a sick-listed employee will be smaller in large companies than in small companies. Furthermore, the company's costs associated with temporary absences may be relatively limited in large companies because the

sick-listed's tasks can be distributed among several colleagues. We include ownership to measure that private and public companies have different economic incentives to dismiss sick-listed employees because private companies in contrats to public companies operate on market conditions. Ownership is also used as an instrument variable: we assume ownership to influence the probability of separation whereas it does not affect the likelihood of re-employment.

The utility of separation will depend on the costs of recruitment and on the job training of a new employee, which in turn is expected to depend on characteristics of the job. To capture this, we include the sick-listed's occupation. Finally, a dummy variable is defined indicating if the company dismissed one or more employees in the year prior to the beginning of the present sick leave. The variable is supposed to reflect that shrinking companies may prefer to abolish the position in question and thus dismiss the sick-listed employee.

The sick-listed's decision with regard to separation depends on the utility of continuing the employment contract relatively to the utility derived from separation. The weighting of these alternatives will depend on the sick-listed present health condition, educational attainment, age, and other personal characteristics (Aarts & de Jong, 1992). Accordingly, we expect that the already mentioned socio-demographic characteristics and the health status variable will capture this aspect.

### 4.2. Participation in education

In all long-lasting cases of sick leave the municipalities' case manager is obliged to assess whether vocational rehabilitation is needed in order to secure the sick-listed's labour market attachment. Consequently, we expect participation in education to be determined by case-managers whose selection of participants is based on the sick-listed's individual characteristics indicating the need for vocational rehabilitation. What is more, we assume that the selection of participants varies across municipalities in that the case-manager's decisions are influenced by the policy of the municipality (cf. e.g. Aakvik, Heckman & Vytlacil, 2000). Previous studies show considerably differences between the tendencies of Danish municipalities' to establish vocational rehabilitation (Gregersen, 1993; Gregersen & Christoffersen, 1999).

The aim of the vocational rehabilitation programme suggests that individuals selected to participate in educational measures have relatively low ex-ante return to work probabili-

ties. This type of selection has been found in Sweden where older, non-trained employees with repeated previous sick leaves are over represented in the vocational rehabilitation programme without having higher ex-post return to work rates (Hashmati & Engström, 2001). The opposite type of selection where case managers select participants with a high ex-ante probability of returning to work in order to obtain good programme results is also possible. Aakvik, Heckman & Vytlacil (2000) find that younger, relatively highly educated persons with a long work experience are over represented in the Norwegian vocational rehabilitation programme. These persons have relatively high ex-post employment probabilities.

The observable individual characteristics we include are: sex, age, educational attainment, cohabitation status at Wave 1, occupation, and seniority. Two measures of the sick-listed's income during sick leave are also included: the sick-listed's income during sick leave relatively to the pre-sick leave wage income,[4] and the income of the sick-listed's spouse divided with the sick-listed's pre-sick leave income. The anticipated effect of the income variables is however ambiguous. On the one hand low rates of income support may reflect a large need for vocational rehabilitation as it may improve employment chances and thus raise future income streams. On the other hand, the income support during education, i.e. vocational rehabilitation benefit, is of the same level as the sickness benefit meaning that participation in education will not raise the income in the short term.

The simultaneously estimated likelihood of separation is also included in the analysis. Separated employees are expected to have a high probability for participation in education because separation indicates that the possibilities of returning to work with the old employer are limited and that other strategies for re-employment such as educational training therefore are necessary.

The municipalities' policy is measured as the tendency to initiate vocational rehabilitation.[5] The individual sick-listed employee's probability of participation in education is

[4]The variable is allowed to change value during the observation period in order to reflect that the replacement rate of employees entitled to wage during sick leave will decrease in case they are separated during sick leave and therefore only are entitled to sickness benefit.

[5]An OLS regression model with all (275) municipalities has been estimated. The dependent variable is defined as the number of persons receiving vocational rehabilitation benefit in 1996 divided with the number of the municipalities' inhabitants aged 18-66. The independent variables, which are measured relatively to the number of inhabitants, include: number of persons receiving sickness benefit, number of persons receiving social assistance, number of owned residences, and number of residences with four rooms. These variables are used to control for structural differences be-tween municipalities in conditions that affect the demand for vocational rehabilitation. The model yields an $R^2$-value on 0.24. The standardised residuals are used to measure the municipalities' tendency to rehabilitate. The data have been obtained from Statistics Denmark (Danmarks Statistiks Databank).

expected to be positive correlated with the municipality's tendency to initiate vocational rehabilitation. This variable is used as an instrument: we expect the rehabilitation policy to influence the probability of participation in education, but not to alter the chance of re-employment after education has been ended. Cf. table 1 for descriptive statistics of the covariates that are used in the estimation of participation in educational measures.

### 4.3. Returning to work

The observable covariates that are expected to influence the likelihood of returning to work concern the sick-listed's socio-demographic characteristics, health status, employment opportunities, and the sick-listed's financial support during sick leave (for a survey of the literature, see Høgelund, 2001; Krause & Lund, forthcoming).

The socio-demographic variables comprise sex, age, and cohabitation status at Wave 1. We include pain intensity to capture that sick-listed employees with a poor health are supposed to have a lower likelihood of returning to work with the old employer and with a new employer, respectively. Thus, an impairment that makes it painful to work will reduce the utility derived from work (Aarts & de Jong, 1992) and as noted reduces the employee's productivity making it less profitable for employers to (re-) employ the employee.

To measure the sick-listed's general employment opportunities that are not related to the health condition we include: educational attainment, a measure of the development in the unemployment level, seniority, and separation. Educational attainment is an indicator of human capital and we therefore expect that it affects the likelihood of returning to work with the old and with a new employer, respectively. We include a time-dependent variable to measure changes in the regional unemployment rate. As the level of unemployment is associated with the competition for jobs at the ordinary labour market it is expected to influence the likelihood of returning to work with a new employer (cf. Aarts & de Jong, 1992). It may also affect the possibilities of returning to work with the old employer because a high unemployment rate reduces recruitment costs, and vice versa. At the same time, increased competition at the ordinary labour market however makes it more attractive for the sick-listed employee to return to the old employer. The estimated likelihood of separation is also included in the analysis. While being separated from the old employer may reduce the chance of returning to this employer, it may stimulate the sick-listed's incentives to find work with a new employer. Seniority reflects company specific human capital and therefore is expected to affect the likelihood of returning to

work with the old employer. As company specific human capital is of less relevance for a new employer, seniority is not expected to affect the chance of returning to work for a new employer.

We include two measures to capture the incentive effects that may arise from a decline of the sick-listed's economic support during sick leave: the replacement ratio during sick leave, i.e. income from sickness benefit (or wage) during sick leave relatively to the pre-sick leave wage, and the income of the sick-listed's spouse relatively to the sick-listed's pre-sick leave wage. The replacement ratio is allowed to change value when separation occurs.

## 5. The econometric model

In this section we propose a model that will statistically analyze simultaneous spells of different nature that might affect the outcome of each other. First we look at spells of sick leave, until the individual return to work. We denote this duration $T_1$. From this spell the individual might exit into two different states, return to work with the old employer and return to work with a new employer. These exits are indicated by two binary dummy variables, $c_{11}$ and $c_{12}$ taking the value 1 if the individual enter the relevant state and zero otherwise.

Before exit to work several things might occur. First the individual might formally separate from the employer, from which he is sick listed. The duration until this happens is denoted $T_2$.[6] Individuals who separate are indicated by a binary variable, $c_2$, taking the value one if separation occurs before return to work and zero otherwise. Second, the individual on sick leave might enter education. The duration until this happens is denoted $T_3$. Individuals making this transition are indicated by the binary variable $c_3$, taking the value one when they enter education and zero otherwise. In addition to these variables a number of covariates are also included in the model. These are denoted by a row vector $x_j$ where the subscript $j$ refers to the type of spell associated with the vector of covariates. Finally, individuals might leave education. The duration from being sick listed and until leaving education is denoted $T_4$. While the other durations are endogenous, we choose to let this duration be exogenous for simplicity. Hence, our model attempts to control for selection bias into education, but not for the duration of education, $T_4 - T_3$.

[6] Both the duration until separation and the duration until entering vocational education are right censored if these events have not occurred before the individual returns to work.

As the durations are measured in months and since the spells typically cover several years, we propose to model each of the different types of spells as piecewise proportional hazard rate models. That is, we think of the spells as measured in continuous time. We want to find the effects of separation from the old employer and participation in education on the duration until returning to work. Therefore, we allow these two endogenous variables to be time dependent covariates in the model of the duration of returning to work. We also want to allow the duration until separation to affect the duration until participation in education but not vice versa.[7] The interaction between the duration until returning to work, separation and education is the core of the analysis, as the frequency of separation and entering a vocational model signifies the difference between the Danish labour market model and the Continental European labour market. The idea is that education compensates for a high flexibility on the labour market, in this instance, in terms of a high frequency of separations.

Formally, by assuming a proportional competing risk hazard rate model, we have the following hazard rates for returning to work:

$$\lambda_{1j}(t) = \varphi^0_{1j}(t)\varphi_{1j}(\beta'_{1j}x_{1j} + \sum_{l=2}^{l=4}\gamma_{1j}c_l(t) + \alpha_{1j}z_{1j}(t) + v_{1j})$$

$j = 1, 2$, where $\varphi^0_{1j}$, $j = 1, 2$ are base line hazard rates, $\varphi_{1j}, j = 1, 2$ is a non-negative function, $z_{1j}, j = 1, 2$ are time dependent exogenous covariates, and where $v_{1j}, j = 1, 2$ are random effects capturing the effect of unobserved covariates. This leads to the following Survival function for returning to work:

$$\begin{aligned} S_1(t) &= P(T_{1j} \geq t | x_{1j}, C_l(0,t)_{l=2,3,4}, Z(0,t), v_j) \\ &= \exp\left[-\int_0^t \sum_{j=1,2} \varphi^0_{1j}(s)\varphi_{1j}(\beta'_{1j}x_{1j} + \sum_{l=2}^{l=4}\gamma_{1j}c_l(s) + \alpha_{1j}z(s) + v_{1j})ds\right] \end{aligned}$$

$j = 1, 2$, and $l = 2, 3, 4$, where $C_l(0,t)$, $l = 2, 3, 4$, is the time path of the censoring variables for separation, entering and exiting education and $Z(0,t)$ is the time path for exogenous time dependent variables. For participation in education we assume the following single risk model:

$$\lambda_3(t) = \varphi^0_3(t)\varphi_3(\beta'_3x_3 + \gamma_3c_2(t) + \alpha_3z(t) + v_3)$$

Thus, participation in education only depends on one endogenous variable, separation. We get the survivor function of time to education in a similar fashion as for return to

[7] We assume that separation takes place prior to the decision of participation in education, because rehabilitation through educational measures aims at providing job opportunities in alternative occupations. This is supported by the empirical hazard rates, cf. figure 1a and 1b.

work. Finally, we have a single risk model for time to separation, which does not depend on endogenous variables (cf. footnote 7):

$$\lambda_2(t) = \varphi_2^0(t)\varphi_3(\beta_2' x_2 + \alpha_2 z(t) + v_2)$$

We allow the random effects $v_j$, $j = 11, 12, 2, 3$ to be correlated.

We have to take into account the fact that durations and thus also the distribution of unobservables is conditional on survival until the individual is selected into the sample, denoted $t^*$. That is, we need to find survivor functions of returning to work, separation and entering education and the distribution of the random effects conditional on not having returned to work before $t^*$, not being saperated before $t^*$ and not having entered education before $t^*$. For $T_1$ we find:

$$\begin{aligned}
&\widetilde{S}_1(t|T_1 \geq t^*, t_2, t_3, v_{11}, v_{12}) \\
&= \frac{P(T_{1j} \geq t|x_{1j}, C_l(0,t), Z(0,t), v_j)}{P(T_{1j} \geq t^*|x_{1j}, C_l(0,t^*), Z(0,t^*), v_j)} = \frac{S_1(t)}{\widetilde{S}_1(t)} \\
&= \exp\left[-\int_{t^*}^{t} \sum_{j=1,2} \varphi_{1j}^0(s)\varphi_{1j}(\beta_{1j}' x_{1j} + \sum_{l=2}^{l=4} \gamma_{1j} c_l(s) + \alpha_{1j} z_{1j}(s) + v_{1j})ds\right]
\end{aligned}$$

because we know that during period $0-t^*$ the variables $c_j(s) = 0, j = 2, 3, 4$. The survivor functions $\widetilde{S}_2$ and $\widetilde{S}_3$ are found in a similar manner. Finally, the distribution of the random effects is:

$$h(\mathbf{v}|\mathbf{T} \geq t^*) = \frac{[S_1(t^*|v_{11}, v_{12})] \times \prod_{j=2}^{j=3} [S_j(t^*|v_j)]\, h(\mathbf{v})}{\int [S_1(t^*|v_{11}, v_{12})] \times \prod_{j=2}^{j=3} [S_j(t^*|v_j)]\, h(\mathbf{v}) d\mathbf{v}}$$

where $\mathbf{T} = \{T_1, T_2, T_3\}$, $\mathbf{v} = \{v_{11}, v_{12}, v_2, v_3\}$, see Lancaster (1990).

### 5.1. Parameterization

To allow for a very flexible baseline hazard, we adopt the piecewise exponential hazard framework for $\lambda_{0j}, j = 11, 12, 2, 3$. That is, $\lambda_{0j}$ are constant within say $1, .., M$ intervals, but may vary between intervals. We can write the integrated hazard as:

$$\begin{aligned}
\Lambda_j(t_1, t_2) &= \int_{t_1}^{t_2} \sum_{j=11,12} \varphi_j(s)\varphi_{1j}^0(s)ds \\
&= \int_{t_1}^{t_2} \sum_{j=11,12} \varphi_{1j}(s) \exp\left(\sum_{m=1}^{M} \lambda_{jm} d_m(s)\right) ds,
\end{aligned}$$

where $\varphi_{1j}^0(s) = \exp(\lambda_{1jm}); c_{m-1} \leq t \leq c_m$, $\varphi_{1j} = \exp(\beta_{1j}' x_{1j} + \sum_{l=2}^{l=4} \gamma_{1j} c_l(s) + \alpha_{1j} z(s) + v_{1j}), j = 1, 2$ and

$$d_m(t) = \begin{cases} 1 & \text{if } c_{m-1} \leq t \leq c_m; m = 1, 2, .., M \\ 0 & \text{otherwise} \end{cases}$$

$m = 1, 2, .., M$, showing only the case for $j = 11, 12$, with similar results for $\Lambda_2$ and $\Lambda_3$. Note that with the piecewise constant specification of the baseline hazard rate and the knowledge that neither separation nor entering education has occurred, we get some further simplifications of the conditional distribution of the random effects:

$$\begin{aligned} h(\mathbf{v}|\mathbf{T} \geq t^*) &= \frac{\exp\left(-\int_0^{t^*} \sum_j \varphi_j^f \varphi_j^t(s)\varphi_j^0(s)ds\right) h(\mathbf{v})}{\int \exp\left(-\int_0^{t^*} \sum_j \varphi_j^f \varphi_j^t(s)\varphi_j^0(s)ds\right) h(\mathbf{v})d\mathbf{v}} \\ &= \frac{\exp\left(-\sum_j \varphi_j^f \Lambda_j(s)\right) h(\mathbf{v})}{\int \exp\left(-\sum_j \varphi_j^f \Lambda_j(s)\right) h(\mathbf{v})d\mathbf{v}} \end{aligned} \tag{5.1}$$

where $\Lambda_j(s) = \int_0^{t^*} \varphi_{1j}^t(s)\varphi_{1j}^0(s)ds$ and where index $j$ runs through: $11, 12, 2, 3$ and assuming that $t^*$ is equal to some $c_m$. Differentiating with respect to any parameters in (1) yields the same constant value for all values of these parameters. Hence no parameters are identifiable from (1) alone. Therefore no baseline hazard rate parameters referring to durations shorter than $t^*$ are identifiable, see also Holm (in press).

As we have no information on the functional form of $h(.)$, the density of the random effects, a non-parametric discrete distribution is assumed, following the work of Lindsay (1983), with past applications in econometric hazard models, see e.g. Meyer (1990) and Gritz (1993).[8] That is, we represent the unknown distribution of $v_{11}, v_{12}, v_2, v_3$ by a non-parametric distribution with a finite number of points of support. Here $e^l = e_{11}^l, e_{12}^l, e_2^l, e_3^l$ represent a pair of discrete points of support with probability $p_l$. To get the unconditional log-likelihood based on observed variables, given $\mathbf{T} > t^*$, we must sum over all possible values of $e^l$, take logs and sum over $n$ observations (ignoring censoring for simplicity):

$$\log l^J = \sum \ln \sum_{l=1}^{L} \prod_{j=1}^{j=2} \left[\lambda_{1j}(t_1|e_{1j}^l)_1^{c_{1j}} \widetilde{S}(t_1|e_{1j}^l)\right] \times \prod_{j=2}^{j=3} \left[\lambda_j(t_j|e_j^l)_j^{c_j} \widetilde{S}(t_j|e_j^l)\right] p(e^j|T \geq t_i^*)$$

This is the log-likelihood from which parameter estimates are obtained. It is conditional on the number of points of support, $L$. This number can be determined in the following way: Let $l_i^L$ be individual contributions to the log likelihood using $L$ mass points and define the following function $D = \sum_{i=1}^{n} [l_i^1/l_i^L - 1]$,where the upper part of the fraction is

[8] Consistency of a non-parametric representation of an unknown distribution of heterogeneity in the case of a Weibull hazard rate model is shown by Heckman and Singer (1984).

individual contributions to the log likelihood using only one mass point in the model and the lower part is individual contributions to $l_i^L$ using $L$ mass points for the non-parametric representation of the unknown bivariate mixing distribution.

By a theorem of Lindsay (1983), the value of $L$ yielding $D = 0$ provides an optimal mixing distribution in the sense that a mixing distribution including a higher number of mass points will not yield a higher value of the semi-parametric likelihood.

## 6. Findings

The parameter estimates of the simultaneously estimated hazard models of separation, participation in education, returning to work with the old employer, and returning to work with a new employer, are presented below in table 2a-d. The results in column one and two concerns the model without unobserved heterogeneity. The results in column three and four concern the model with correlated unobserved heterogeneity. This model needs three points of support in each dimension of the distribution of unobserved heterogeneity in order to get $D = 0$ (see the previous section). Hence, emphasis is put on the estimates of the model with unobserved heterogeneity.

### 6.1. Separations

The estimations of the observable covariates provide some support for the anticipated effects. The effect of seniority is as expected: the probability of separation declines with seniority. This supports that company specific human capital is important for separation. Also the effect of ownership is as expected, with public sector employees having a lower probability of separation than private sector employees. As mentioned in section 4.1, this may reflect that private companies respond more to economic incentives than public companies.

**Table 2a. Hazard rate to separation**

| | Without random effects | | With random effects | |
|---|---|---|---|---|
| Variable | Parameter | Std error | Parameter | Std error |
| Ownership (Public=1) | 0.342** | 0.151 | -0.394*** | 0.152 |
| Company size | 0.445 | 0.644 | -0.335 | 0.711 |
| Company size missing | -0.241 | 0.260 | -0.362 | 0.263 |
| Company history (Layoffs in the last year prior to sick leave=1) | 0.177 | 0.180 | 0.208 | 0.183 |
| Company history missing | 0.549* | 0.285 | 0.488 | 0.302 |
| Sex (Female=1) | 0.007 | 0.137 | -0.196 | 0.159 |
| Age | 0.585 | 0.734 | -0.638 | 0.725 |
| Educational attainment: | | | | |
| Secondary (Yes=1) | -0.223 | 0.262 | -0.074 | 0.257 |
| Tertiary (Yes=1) | -0.065 | 0.308 | 0.116 | 0.307 |
| Seniority | -0.304*** | 0.081 | -0.395*** | 0.085 |
| Occupation: | | | | |
| Manager, professional (Yes=1) | -0.723** | 0.336 | -0.295 | 0.351 |
| Sales, service (Yes=1) | 0.059 | 0.277 | -0.023 | 0.285 |
| Craft and plant work (Yes=1) | 0.206 | 0.266 | -0.226 | 0.255 |
| Pain intensity: 1 to 10 (Much pain) | 0.056** | 0.025 | -0.038 | 0.029 |
| $\lambda_{21}$ | -2.685 | 0.477 | -7.055 | 2.248 |
| $\lambda_{22}$ | -2.100 | 0.470 | -6.132 | 2.248 |
| $\lambda_{23}$ | -2.624 | 0.492 | -6.167 | 2.256 |
| $\lambda_{24}$ | -2.893 | 0.496 | -5.803 | 2.265 |
| $\lambda_{25}$ | -5.863 | 0.514 | -6.198 | 2.231 |

Note: Significance levels: *** significant at 1%, ** significant at 5%, * significant at 10%

The other observable covariates do not have the expected importance. Age, health status (pain intensity), educational attainment, occupation, company size, and company history (layoffs in the year prior to the sick leave), are insignificant thus giving no further support to the importance of productivity and employer characteristics for separations.

### 6.2. Participation in education

The participation in educational measures is affected both by the municipalities' policy and by personal characteristics of the sick-listed employees. Municipalities with an above average tendency to establish vocational rehabilitation often select the long-term sick-listed employees for participation in educational measures. In other words, the municipalities seem to differ in their emphasis on vocational rehabilitation measures, which in turn influences the sick-listed's chance of participating in educational measures.

**Table 2b. Hazard rate to education**

| | Without random effects | | With random effects | |
|---|---|---|---|---|
| Variable | Parameter | Std error | Parameter | Std error |
| Separation (Yes=1) | 0.548** | 0.247 | 1.118** | 0.532 |
| Municipalities' vocational rehabilitation tendency | 0.173*** | 0.063 | 0.158** | 0.063 |
| Compensation ratio | 0.591 | 0.543 | 0.070 | 0.573 |
| Compensation ratio missing | 0.346 | 0.507 | -0.032 | 0.514 |
| Spouse income ratio | 0.487** | 0.208 | 0.542*** | 0.205 |
| Spouse income ratio missing | 0.588* | 0.338 | 0.662** | 0.334 |
| Sex (Female=1) | -0.347 | 0.239 | -0.380 | 0.240 |
| Age | -3.684*** | 1.164 | -4.086*** | 1.161 |
| Cohabitation status (Living with spouse=1) | -0.421 | 0.289 | -0.515* | 0.285 |
| Educational attainment: | | | | |
| Secondary (Yes=1) | 0.282 | 0.499 | -0.042 | 0.428 |
| Tertiary (Yes=1) | 0.117 | 0.556 | -0.230 | 0.497 |
| Seniority | -0.091 | 0.145 | -0.087 | 0.143 |
| Occupation: | | | | |
| Manager, professional (Yes=1) | -0.026 | 0.512 | -0.079 | 0.481 |
| Sales, service (Yes=1) | -0.105 | 0.404 | -0.121 | 0.376 |
| Craft and plant work (Yes=1) | -0.182 | 0.388 | -0.323 | 0.364 |
| Pain intensity: 1 to 10 (Much pain) | -0.091** | 0.042 | -0.100** | 0.042 |
| $\lambda_{31}$ | -3.652 | 0.857 | -3.312 | 1.306 |
| $\lambda_{32}$ | -2.037 | 0.884 | -1.705 | 1.302 |
| $\lambda_{33}$ | -2.809 | 0.911 | -2.490 | 1.133 |
| $\lambda_{34}$ | -3.110 | 0.954 | -2.651 | 1.329 |
| $\lambda_{35}$ | -3.741 | 0.931 | -3.368 | 1.310 |

Note: Significance levels: *** significant at 1%, ** significant at 5%, * significant at 10%

The evidence about the hypothesis that case-managers follow the intentions of the vocational rehabilitation programme and select individuals with low ex-ante return to work probabilities is mixed. On the one hand, exit to educational measures is high for sick-listed employees with poor health status, living without a spouse, and who are separated from their old employer. On the other hand, age has a negative and strong effect on participation. This may reflect that expected future benefits from an increased educational level decreases with age, which in turn may affect both the decision of the sick-listed employees and of the case-manager. The presence of creaming in the selection process is also supported by the fact that the net effect of educational measures on the likelihood of returning to work with a new employer slightly decreases when random effects are included in the model.

The sick-listed's compensation ratio is insignificant suggesting that there is no direct eco-

nomic incentive effects. The spouse's income ratio yields however a significant coefficient: exit to educational measures increases when the income of the spouse is high compared to the sick-listed pre-sick leave income. This may reflect that participation in educational measures is likely when the sick-listed's spouse is capable of providing income support to compensate for the temporary decrease in income that may follow from participation in educational measures.

### 6.3. Returning to work with the old employer

While separation from the old employer is highly significant in the model for returning to work with the old employer without random effects, it is insignificant in the model with random effects. This suggests that the characteristics of the persons who are separated matters rather than separation in itself. That is, persons with a low return to work potential, e.g. with a poor health or low work motivation, both have a high probability of being separated and a low probability of returning to work.

The effect of participation in education is insignificant although the coefficients have the expected signs indicating the presence of both a weak locking-in effect, which reduces the likelihood of returning to work with the old employer, and a weak and positive effect when the education is completed. The absence of an educational effect is further supported in that also the sick-listed's educational attainment is insignificant. Combined with a positive effect of seniority, this may suggest that company specific human capital is crucial for the transition to work with the old employer whereas general human capital is of less relevance.

Age has a negative effect on exit to work with the old employer. As the effect of company specific human capital apparently is captured by seniority, it is likely that the importance of age reflects that older employees have a relatively low productivity or that they prefer to retire sooner than younger employees. The latter may imply that the net cost of replacing older sick-listed employees will be limited because they will only stay with the employer for a short period irrespective of their work incapacity.

**Table 2c. Hazard rate for returning to work with the old employer**

| | Without random effects | | With random effects | |
|---|---|---|---|---|
| Variable | Parameter | Std error | Parameter | Std error |
| Separation (Yes=1) | -2.647*** | 0.325 | 1.339 | 1.349 |
| Time to education, start | -0.229 | 0.622 | -0.273 | 0.632 |
| Time to education, termination | 0.381 | 0.778 | 0.461 | 0.747 |
| Compensation ratio | 2.232*** | 0.322 | 2.183*** | 0.375 |
| Compensation ratio missing | 0.469 | 0.538 | 1.090** | 0.528 |
| Spouse income ratio | 0.148 | 0.285 | 0.167 | 0.262 |
| Spouse income ratio missing | 0.085 | 0.434 | 0.164 | 0.423 |
| Change in regional unemployment rate | -0.379* | 0.204 | -0.275 | 0.196 |
| Sex (Female=1) | -0.489* | 0.267 | -0.326 | 0.275 |
| Age | -2.742* | 1.629 | -3.097* | 1.676 |
| Cohabitation status | | | | |
| (Living with spouse=1) | 0.022 | 0.383 | 0.118 | 0.368 |
| Educational attainment: | | | | |
| Secondary (Yes=1) | 0.356 | 0.573 | 0.422 | 0.638 |
| Tertiary (Yes=1) | 0.368 | 0.643 | 0.394 | 0.703 |
| Seniority | 0.340** | 0.141 | 0.489*** | 0.146 |
| Occupation: | | | | |
| Manager, professional (Yes=1) | 0.591 | 0.643 | 0.696 | 0.803 |
| Sales, service (Yes=1) | 0.043 | 0.609 | 0.311 | 0.772 |
| Craft and plant work (Yes=1) | 0.429 | 0.591 | 0.832 | 0.763 |
| Pain intensity: 1 to 10 (Much pain) | -0.215*** | 0.051 | -0.164*** | 0.053 |
| $\lambda_{11}$ | -3.726 | 0.999 | -4.330 | 1.319 |
| $\lambda_{12}$ | -2.714 | 1.012 | -3.384 | 1.303 |
| $\lambda_{13}$ | -2.661 | 1.042 | -3.502 | 1.292 |
| $\lambda_{14}$ | -4.991 | 1.583 | -5.559 | 1.547 |
| $\lambda_{15}$ | -5.042 | 1.458 | -5.474 | 1.459 |

Note: Significance levels: *** significant at 1%, ** significant at 5%, * significant at 10%

Pain intensity has a large and negative effect suggesting that health is decisive for the probability of returning to work with the old employer. In contrast to what we expected, the compensation ratio has a positive effect meaning that employees with a high compensation ratio have high probabilities of returning to work. Consequently, other effects probably dominate possible incentive effects. For instance employees with high compensation ratios are often white-collar employees who hold less demanding jobs and possess other qualifications than blue-collar employees.

### 6.4. Returning to work with a new employer

Like in the model for returning to work with the old employer, separation appears to be endogenous to returning to work with a new employer. But in contrast to returning to

work with the old employer, the effect of separation increases when random effects are included. The coefficient of separation increases from zero in the model without random effects to 2.43 in the model with random effects and thus almost becomes significant at a 5 percent level.

**Table 2d. Hazard rate for returning to work with a new employer**

| | Without random effects | | With random effects | |
|---|---|---|---|---|
| Variable | Parameter | Std error | Parameter | Std error |
| Separation (Yes=1) | 0.045 | 0.282 | 2.431* | 1.415 |
| Time to education, start | -2.543*** | 0.863 | -2.320*** | 0.735 |
| Time to education, termination | 2.949*** | 0.870 | 2.623*** | 0.740 |
| Compensation ratio | 0.385 | 0.380 | 0.350 | 0.396 |
| Compensation ratio missing | 0.290 | 0.350 | 0.339 | 0.375 |
| Spouse income ratio | 0.164 | 0.228 | 0.272 | 0.229 |
| Spouse income ratio missing | -0.156 | 0.336 | -0.091 | 0.348 |
| Change in regional unemployment rate | -0.033 | 0.131 | -0.011 | 0.134 |
| Sex (Female=1) | -0.478** | 0.226 | -0.533** | 0.241 |
| Age | -3.070*** | 1.098 | -3.559*** | 1.124 |
| Cohabitation status | | | | |
| (Living with spouse=1) | -0.338 | 0.268 | -0.436 | 0.269 |
| Educational attainment: | | | | |
| Secondary (Yes=1) | 1.100 | 0.795 | 0.300 | 0.567 |
| Tertiary (Yes=1) | 1.448* | 0.826 | 0.641 | 0.616 |
| Seniority | -0.438** | 0.174 | -0.464*** | 0.176 |
| Occupation: | | | | |
| Manager, professional (Yes=1) | -0.368 | 0.456 | -0.358 | 0.463 |
| Sales, service (Yes=1) | -0.618* | 0.372 | -0.593 | 0.374 |
| Craft and plant work (Yes=1) | -0.206 | 0.339 | -0.211 | 0.332 |
| Pain intensity: 1 to 10 (Much pain) | -0.214*** | 0.043 | -0.228*** | 0.043 |
| $\lambda_{11}$ | -3.540 | 1.001 | -2.843 | 1.947 |
| $\lambda_{12}$ | -1.817 | 0.974 | -1.394 | 1.883 |
| $\lambda_{13}$ | -2.111 | 0.995 | -1.694 | 1.873 |
| $\lambda_{14}$ | -2.603 | 1.026 | -2.150 | 1.870 |
| $\lambda_{15}$ | -2.641 | 1.026 | -2.115 | 1.848 |

Note: Significance levels: *** significant at 1%, ** significant at 5%, * significant at 10%

Participation in educational measures yields as expected a large and negative locking-in effect and a large and positive effect of completing the educational measures. As the two effects are of the same size the net effect is slightly positive.

Age and health status (pain intensity) have similar effects as in the model for returning to work with the old employer. That is, sick-listed with good health have a considerably higher transition to work with a new employer than sick-listed with poor health, while younger employees have much higher transition rates than older employees.

As expected, seniority has no impact on exit to work with a new employer. As seniority is highly significant for returning to work with the old employer, cf. above, the results support that company specific human capital is more relevant for work retention than for external employment. In contrast to the model for returning to work with the old employer, gender is significant with females having a lower exit rate than males.

In sum, the findings indicate that in certain respects the same factors affect the chance of returning to work with the old employer and a new employer, respectively. This is the case for health and age. In other respects the factors that influence the two outcomes differ. This is most clearly illustrated by the importance of seniority but also by the effects of gender and separation.

### 6.5. The distribution of random effects

Table 2e shows the estimates of the distribution of random effects. The distribution has three points of support in each dimension of the distribution of unobserved heterogeneity, suggesting that the data can be considered as comprising three distinct groups of long-term sick-listed employees.

**Table 2e. Distribution of random effects**

| | Parameter | Std error |
|---|---|---|
| Hazard rate to separation | | |
| $e_{21}$ | 0 | - |
| $e_{22}$ | 6.120 | 2.225** |
| $e_{23}$ | -2.334 | 3.21 |
| Hazard rate to education | | |
| $e_{31}$ | 0 | - |
| $e_{32}$ | 0.134 | 1.245 |
| $e_{33}$ | 1.255 | 1.107 |
| Hazard rate for returning to work with the old employer | | |
| $e_{111}$ | 0 | - |
| $e_{112}$ | –4.069 | 1.455*** |
| $e_{113}$ | 0.351 | 0.686 |
| Hazard rate for returning to work with the old employer | | |
| $e_{121}$ | 0 | - |
| $e_{122}$ | -1.763 | 2.597 |
| $e_{123}$ | 1.259 | 1.745 |

Note: Significance levels: *** significant at 1%, ** significant at 5%, * significant at 10%

One group of about 72% has very poor chances in the labour market; they have a high risk

of being separated from the old employer, a low probability of returning to work either with the old employer or with a new employer. They do however have an average chance of participating in education, which unfortunately does not seem to help them back to work. Another group of about 20% has very good prospects; they run a little risk of being separated and they have a high exit rate to work with the old and especially with a new employer, and they have high exit rates to educational measures, which they however do not seem to need. Finally, the third group of about 8% has an intermediate position in respect to the four studied events.

## 7. Conclusion

The approach we use in this paper diverges from that used in previous studies. In contrast to previous return to work studies, we distinguish between returning to work with the old employer and with a new employer. We also allow for the effect of unobservable covariates through random effects. This approach yields further insight into the mechanisms that influence labour market reintegration of long-term sick-listed employees. The findings support that the process of returning to work with the old employer is different from the process of returning to work with a new employer. Although health and age have similar effects on both outcomes, we find that seniority only matters for returning to work with the old employer, while gender only matters for returning to work with a new employer. The influence of health and seniority can be interpreted as if sick-listed employees with a good health and much company specific human have a high productivity, making it attractive for the employer to continue the labour contract. This interpretation is also supported by the finding that sick-listed employees with good health and high seniority have high exit rates to the old employer at a much earlier stage in the sickness spell than exit to a new employer.

The above suggests that the decision of separation from the old employer is a first important milestone that influences the labour market outcome. The majority of those who are separated are forced to find a new job, while the majority of those who are not separated stay with the old employer. As the fraction of sick-listed employees that return to work is much lower among those who are separated than among those who are not separated this could lead to the conclusion that separation has a direct effect on the probability of returning to work. When random effects are included, however, we find separation to have no direct effect on the transition to the old employer and an almost significant and positive effect on the transition to a new employer. This apparent paradox is caused by

unobserved heterogeneity: employees that are separated have unobserved characteristics that not only increase the probability of separation, but also reduce their chance of returning to work. In other words, separations effectively detach employees with high and low employability.

The Danish disability policy intents to help sick-listed with low employability to work through participation in vocational rehabilitation. This aim seems not to be fulfilled as we find a creaming tendency in the selection into educational measures. A group of sick-listed employees has unobserved characteristics that both lead to high ex-post return to work rates and high exit rates to educational measures. This effect overrules that sick-listed with observable characteristics such as poor health having low ex-post return to work rates also have high exit rates to educational measures. It is possible, therefore, that case-managers in fact aim at selecting the weakest to participate in educational measures, but only succeed partly. On objective measures, such as information on health and on whether the sick-listed individuals are seperated from the old employer, they select those with low re-employment probabilities. However, on characteristics that are less objective and unobserved in our study, e.g. work motivation, the case-managers apparently select indivuiduals with high re-employment probabilities.

Furthermore, participation in educational measures seems on average not significantly to help the sick-listed back to work. This result is in accordance with previous studies that find no or even negative effects of vocational rehabilitation and educational measures. By modelling both the timing of the start and the completion of education measures, we find that educational measures only influence the return to work with a new employer and that the net effect is insignificant. This is because negative locking-in effects almost cancel the positive effects of completing the measures.

In Denmark, the responsibility for the reintegration of long-term sick-listed employees rests to a large extent with public authorities, while employers have a limited responsibility. Earlier studies show that as a consequence educational and other vocational rehabilitation measures often are established and that employers often dismiss employees during sick leave. The evidence put forward in this study suggests surprisingly that the direct effect of separations is limited, and positive. The employees that are separated seem to have (unobserved) characteristics such as poor health or low work motivation that reduce their chances on the labour market. Consequently, it may be argued that the employers' dismissal of sick-listed employees is rational because they shed employees with low productivity. It may be concluded, therefore, that the lax job protection legis-

lation and the following high numbers of dismissals facilitate an efficient job match. An important drawback appears however to be that many sick-listed employees loose their attachment to the old employer, and, because of poor employment opportunities, only have a limited chance of returning to work. Furthermore, this chance is not improved by participation in educational measures.

## References


[1] Aakvik, A., Heckman, J. J. & Vytlacil, E. J. (2000) Treatment effects for discrete outcomes when responses to treatment vary among observationally identical persons: an application to Norwegian vocational rehabilitation programs. Cambridge: National Bureau of Economic Research.

[2] Aarts, L. J. M. & de Jong, P. R. (1992), Economic Aspects of Disability Behavior. Elsevier Science Publishers B.V. Amsterdam, Holland.

[3] Andersen, B. R. (1971) Grundprincipper i Socialpolitikken. Socialpolitisk Forening. Copenhagen.

[4] Bergendorff, S. et al. (1997), Resultat av arbetslivsinriktad rehabilitering och köb av tjänst in: Marklund, S. (eds.): Risk- & Frisk faktorer sjukskrivning och rehabilitering i Sverige. Riksförsäkringsverket Redovisar 1997:6.

[5] Bergendorff, S. and Gordon, D. (2001), Vocational and Other Non-medical Interventions in: Bloch, F. S. & Prins, R. (eds.): Who Returns to Work and Why? A Six-Country Study on Work Incapacity and Reintegration. New Jersey: Transaction Publishers.

[6] Berkowitz, M. et al. (1988) Measureing the Efficiency of Public Programs. Costs and Benefits in Vocational Rehabilitation. Philadelphia: Temple University Press.

[7] Bound, J. (1990) Self-Reported versus Objective Measures of Health in Retirement Models. *Journal of Human Resources*, vol. XXVI, no. 1, pp.106-138

[8] Colbjørnsen, T. (1985), Dividers in the Labor Market. Norwegian University Press.

[9] Cornfield, D. B. (1982), Senority, Human Capital and Layoffs: A Case Study. *Industrial Relations*, 21, 3, p. 352-364.

[10] Frölich, M., Heshmati, A. & Lechner, M. (2000) A Microeconometric Evaluation of Rehabilitation of Long-term Sickness in Sweden. SEE/EFI Working Paper Series in Economics and Finance No. 373. Sweden.

[11] Gregersen, O. (1993), Kommunernes brug af revalideringsydelsen. Report 93:7. Copenhagen: the Danish National Institute of Social Research.

[12] Gregersen, O. & Christoffersen, M. N. (1999), Langvarige sociale sager – klienternes holdninger. Report 99:6. Copenhagen: the Danish National Institute of Social Research.

[13] Gritz, R. M., (1993), 'The Impact of Training on the Frequency and Duration of Employment', *Journal of Econometrics*; vol. 57, pp. 21-51.

[14] Heckman, J. and B. Singer, (1984), 'A Method for Minimizing the Distributional Assumptions in Econometric Models for Duration Data', *Econometrica*, vol. 52, pp. 271-320.

[15] Heshmati, A. & Engström, L. G. (2001), Estimating the effects of vocational rehabilitation programs in Sweden in: Lechner, M. & Pfeiffer, F. (eds.): Econometric Evaluation of Labour Market Policies. ZEW Economics Studies 13. New York: Physica-Verlag.

[16] Holm, A. (In press), The Effect of Training on Search Durations; A Random Effects Approach, *Labour Economics*.

[17] Høgelund, J. (2000), Bringing the Sick Back to Work. Labour Market Reintegration of the Long-Term Sick-Listed in the Netherlands and Denmark. Unpublished PhD dissertation, Roskilde University and the Danish National Institute of Social Research.

[18] Høgelund, J. (forthcoming) Reintegration: public or private responsibility? Consequences of Dutch and Danish policies towards disabled workers, forthcoming in *International Journal of Health Services*.

[19] Høgelund, J. (2001) Work Incapacity and Reintegration: A Literature Review in: Block, F. S. & Prins, R. (eds.): Who Returns to Work and Why? A Six-Country Study on Work Incapacity & Reintegration. New Brunswick and London: Transaction Publishers.

[20] Krause, N. & Lund, T. (forthcoming) Return to Work in Barling, J. & Frone, M. R. (eds.) The Psychology of Workplace Safety, Journal of Occupational Health Psychology.

[21] Lancaster, T. (1990) The Econometric Analysis of Transition Data. Cambridge University Press.

[22] Lindsay, B. G., (1983), 'The Geometry of Mixture Likelihoods: A general Theory', *The Annals of Statistics*, vol. 11, pp. 86-94.

[23] Meyer, B. D. (1990), 'Unemployment Insurance And Unemployment Spells', *Econometrica*, Vol. 58, pp 757-782.

[24] Veerman, T. J. & Palmer, E. (2001), Work Resumption and the Role of Interventions in: Bloch, F. S. & Prins, R. (eds.): Who Returns to Work and Why? A Six-Country Study on Work Incapacity and Reintegration. New Jersey: Transaction Publishers.

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