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A Microeconometric Evaluation of Rehabilitation of Long-term Sickness in Sweden

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Abstract

In this study the effects of various types of rehabilitation programmes on labour market outcomes are estimated. A main feature of this study is that it jointly evaluates multiple treatments by nonparametric matching estimators. The study is based on a large sample of persons in western Sweden who are long-term sick and could participate in rehabilitation programmes. Our results suggest that work-place training is superior to the other rehabilitation programmes with respect to labour market outcomes, but compared to non-participation no positive effects are found.

Keywords: Programme evaluation, matching, multiple treatments, multi-programme causal models, long-term sickness, vocational rehabilitation, Swedish labour markets.
JEL classification: C50, H43, I12, J26, J31

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1 Introduction

In 1991 a reform process was initiated in the Swedish rehabilitation policy, which led to a remarkable expansion in vocational rehabilitation (VR) activities in Sweden. This paper estimates the causal effects of various Swedish VR programmes on subsequent employment status using very informative individual data of participants and non-participants.

So far, rigorous evaluation of vocational rehabilitation in Sweden regarding its success in re-integrating individuals in the labour market has been limited by data availability problems and methodological difficulties due to typical selectivity problems (e.g. Angrist and Krueger, 1999, Heckman, LaLonde, and Smith, 1999). The latter arise because individuals may self-select into particular rehabilitation programmes. Furthermore, case workers and local managers of rehabilitation programmes may select programme participants in ways as to enhance successful programme outcomes, or alternatively select the most needy participants with severe illnesses and little prospects on successful re-integration.

In addition to selection any empirical analysis should also take account of the heterogeneity of the Swedish rehabilitative activities which consist of different vocational, medical, and social programmes, that pursue different goals and are targeted at different groups. This requires a careful analysis of the institutional environment and the selection process through which participants enter in rehabilitation, an informative data set to identify the causal effects of rehabilitation and an adequate econometric method to estimate them.

Previous studies about the Swedish rehabilitation system only sporadically attended such selection issues. Marklund (1995) observed a positive correlation between participation in VR and disability pension and found that participants' health status after rehabilitation affected the decision making concerning disability pension. Bergendorff, Lidwall, Ljungberg, and Marklund (1997) detected further a high correlation between long-term sickness and multiple risk factors, such as advanced age, unemployment, occupational- and work environment. Selander, Marnetoft, Bergroth, and Ekholm (1997) pointed out that inefficiency and weak co-ordination in the rehabilitation system remained even after the reform period. They found significant differences in the participation probabilities and post-rehabilitation health development by county, employment status, gender, citizenship, and length and type of rehabilitation, and concluded that unemployed individuals are particularly difficult to rehabilitate. This is confirmed by Menckel and Strömberg (1996) who found that these differences according to employment status can to some extent be attributed to early involvement of occupational health units in the co-ordination of workplace-based rehabilitation.

None of these earlier Swedish studies estimated the effects of participating in rehabilitation. An exception is Heshmati and Engström (2001), who estimated treatment effects relying on a parametric selectivity model and found that participation in VR has positive effects on participants' health status and on their return to work but did not observe any evidence of selection on unobservable characteristics.

In this paper we estimate nonparametrically a variety of treatment effects, using matching estimators for multiple treatments proposed by Imbens (2000) and Lechner (2001) taking into account the different compositions of characteristics among participants and non-participants as well as the heterogeneity of the offered rehabilitation programmes. Thereby we allow different rehabilitation programmes to affect different individuals differently. We estimate not only if participation in rehabilitation was beneficial to the labour market prospects of the participants on average but also whether it had been more appropriate to participate in a different programme than in the one actually observed to participate in.

Identifying treatment effects by matching methods essentially requires that all variables that affect simultaneously the participation decision and subsequent labour market outcomes, are observed. Thus an informative data set and detailed knowledge of the institutional framework are indispensable. We argue that due to the specifics of the Swedish institutions and the selection process and especially due to the very informative data set available these identification conditions are satisfied. In particular, we follow the multivariate-balancing score matching implementation discussed in Lechner (2002a).[1]

The main contributions of this paper are twofold. First, it estimates the effects of various rehabilitative measures, and second, it adds experience regarding the application of these new methods of multiple treatment evaluation with matching techniques. No positive labour market effects of rehabilitation have been found. The different programmes could be ranked according to their re-employment performance into no rehabilitation and work-place rehabilitation, which are most successful, followed by medical and social rehabilitation, which are less successful, and finally concluded by educational evaluation, which might even harm re-employment chances. The proposed estimators turn out to be applicable for the current application, which might be an indication of their general usefulness for evaluation studies based on informative data.

In Section 2 the Swedish social insurance system and the rehabilitation programmes are briefly explained. Section 3 describes the data used and Section 4 the estimation method employed to estimate the causal effects. The estimation results are discussed in Section 5 and Section 6 concludes. An appendix with a description of the data set and additional tables is available on the Internet (*www.siaw.unisg.ch/lechner)*. Further details and references are found in Frölich, Heshmati, and Lechner (2000).

2 Vocational rehabilitation in Sweden

2.1 Long-term sickness and selection into rehabilitation

Vocational rehabilitation is intended to assist sick individuals in restoring their lost working capacity and in becoming independent of the welfare system. Ultimately it is the occurrence of a previously sick person finding a job in the regular labour market *because of* participation in rehabilitation that would be considered as a successful outcome. In addition, it would be considered as a partial success if rehabilitation contributed to an increased working capacity, even if the individual remained unemployed or enrolled in education. Hence, we consider two outcome variables: *re-employment* and *re-integration in the labour force*.[2]

Given the non-experimental setting, our identification strategy for the effects of rehabilitation requires that *all* variables that *simultaneously* affect the participation decision and the potential outcomes are observable.[3] This requires first a careful analysis of the institutional details and the decision making process through which individuals entered into rehabilitation. This process, as it was relevant after the reform in 1991, is described in Figure 2.1

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1 First applications of this approach are Brodaty, Crépon, and Fougère (2001), Dorsett (2001), and Larsson (2003).

2 To identify the effects of rehabilitation on subsequent health status, the available data were not sufficiently detailed to satisfy the nonparametric identification condition of Section 4. Frölich, Heshmati, and Lechner (2000) consider also the effects on exits to disability pensions, but no significant results are obtained.

---------------------------------- Figure 2.1 about here (or further below) ---------------------------

A person who falls sick or becomes injured (Position A) first notifies her employer or the local social insurance office thereof. Regularly employed individuals receive for the first two weeks sickness benefits from the employer and afterwards from the insurance office (Position B). Unemployed and self-employed individuals receive benefits directly from the IO. Sickness benefits amount to 80% of previous earnings, adjusted for the degree of lost working capacity and cut at an upper ceiling, and can be received for an unlimited period.

If sickness continues for more than four weeks (Position C), a *rehabilitation assessment* should be carried out within the following 8 weeks, which consists of various medical and non-medical examinations. On the basis of this assessment a decision about the appropriateness of vocational rehabilitation should be taken: If rehabilitation assistance is not necessary and recovery is expected within a year, the individual draws sickness benefits until healthy. If sickness seems to last for more than a year (even with rehabilitation), the individual will be granted disability pension and the case is closed (Position E).

On the other hand, if rehabilitation seems necessary, economically advisable *and* it appears that the sick person can regain her working capacity within a year, a rehabilitation plan is established (Position D). This plan is made by the IO officer, taking into account the rehabilitative needs, the medical assessments, budgetary constraints as well as the individual's preferences. In principle, the employer is obliged to facilitate workplace rehabilitation, according to his possibilities. Otherwise, the insurance office offers alternative rehabilitative measures, which it purchases from hospitals and private providers. Individuals may demand

[3] For alternative identification strategies see for example the survey by Heckman, LaLonde and Smith (1999).

but have neither the right to receive rehabilitation nor the obligation to participate. In case of participation, they receive an additional rehabilitation allowance. About 20% of the long-term sickness cases participated in rehabilitation during the 1990s.

After completing her rehabilitative measures the sick person may be either healthy (Position F) or still sick. If still sick, her recovery chances are re-assessed and she either re-enters the pool of long-term sick or is granted disability pension.

2.2 The rehabilitation programmes

Vocational rehabilitation consists of a variety of programmes, which we classify into 6 different types of treatments: WORKPLACE rehabilitation comprises vocational work training at the current or at a new workplace. EDUCATIONAL rehabilitation consists of educational training towards a new occupation. Both types of education intend to improve employability in the regular labour market. MEDICAL rehabilitation and SOCIAL rehabilitation, on the other hand, rather intend to restore health and basic work capacity, and are not co-ordinated by the insurance office. PASSIVE rehabilitation comprises all kinds of assessments and rehabilitation needs evaluations. The main purpose of these programmes is to assist in deciding whether recovering the previous work capacity is medically possible and economically sensible.[4] Finally, NO REHABILITATION is the treatment of not receiving any rehabilitation.

Some individuals received more than one type of rehabilitation. Since neither the order of these measures is observed, nor whether these measures where given parallel or sequentially,

[4] An example is the programme "Evaluation of Health Status and Work Capacity".

we assigned these cases to the supposedly most substantial measure. For most cases this was MEDICAL rehabilitation.[5]

3 Data and descriptive statistics

3.1 Data

The data used in this study is taken from the Riks-LS data set, which has been collected by the National Social Insurance Board (Riksförsäkringsverket, RFV) for the purpose of evaluating the efficacy of VR. The survey analysed retrospectively 75,000 sickness cases, who had received sickness cash benefit for a period of at least 60 consecutive days between July 1991 and June 1994. The data was collected as three independent cross-sections according to the fiscal years, 1991/92, 1992/93 and 1993/94. In each of these three fiscal years and in each local insurance office 70 cases were randomly selected from all sickness cases with at least 60 days duration and were followed up either until closure of the case or until the data collection period ended in December 1994. Since the same number of cases were drawn in each office but the local offices differ in size sickness cases occurring in smaller insurance offices are over-represented.

The data provides rich information about individual socio-economic variables, details on health status and particularly about the selection process into rehabilitation. In fact we believe that all relevant factors that affect the selection process and the subsequent labour market status are available. The information about the individual prior to the beginning of the sickness spell (Figure 2.1, position A) consists of age, gender, marital status, citizenship,

[5] More details can be found in the appendix.

education, occupation, previous health record, previous participation in VR, employment status, earnings, and earnings loss due to sickness. The individual's environment is characterised by county of residence, community type, local unemployment rate and year of sickness registration. With respect to sickness registration we know which type of medical institution registered sick leave, the initial degree of sickness, any indications of alcohol or drug abuse, and the medical diagnosis.

As outlined in the previous section, selection into rehabilitation proceeds in two steps. First a specialist assembles the medical report and other assessments to judge the need and chances of success of rehabilitation. The initial medical recommendation, the caseworkers non-medical recommendation, and the organisation that carried out the rehabilitation assessment are recorded, revealing important characteristics of the sick person.[6] These experts' opinions which also include some subjective judgements about the sick person's ability, determination, and labour market chances to resume employment are crucial for identifying a treatment effect. In a second step, the insurance office or employer, respectively, will work out a rehabilitation plan together with the sick person. In this stage a variety of medical and non-medical obstacles preventing the client's participation in VR could surface,[7] which are recorded in the data.

Some individuals might try to influence the selection process in a non-recorded way, e.g. by simulating illness to receive disability pension, dropping out of rehabilitation or lacking effort. If such factors are also correlated with the outcomes of interest, the identifying assump-

[6] The officers have clear guidelines to follow for assessing the need and success chances of rehabilitative measures and they do not face any incentive structures for discriminating against particular groups.

[7] The medical factors are due to waiting for treatment or improved health status. Non-medical factors contain, beside others, incomplete education, lack of residential, private reasons, e.g. divorce, child care.

tion would be invalid and the estimated treatment effects could be biased. However, personal contact, medical evaluation, caseworkers' experience and past sickness record are among factors that unveil such attempts.

Information about the rehabilitation period itself is limited to the types of rehabilitative measures received. Unfortunately, no reliable information on the length of rehabilitative measures or their sequential ordering is available. Finally, for closed sickness cases the outflow destination is reported. Yet, at the end of the data collection period still many cases remained unclosed (still sick). Further details are found in the appendix and in Frölich, Heshmati, and Lechner (2000).

3.2 Descriptive statistics

This study is based on 5 counties in Western Sweden with 67 local insurance offices and a total of 10,309 documented long-term sickness cases. We ignored individuals with missing values on important variables, individuals receiving pension benefit at sickness registration, and all individuals in education or aged above 55 to not confuse rehabilitation with early retirement intended to ease labour market pressure. Of the remaining 6,287 cases 3,087 had received some form of rehabilitation.

In Table 3.1 the means of a few selected variables in the subsample of 6,287 cases are presented by treatment group.[8] The average age is about 40 years and women represent the majority of the sickness cases covered. Regarding education and occupation it can be seen that

8 Table A3.1 in the appendix provides descriptive statistics for all variables for the original sample as well as for the selected subsample used in the estimation. To conserve space the Appendix is available on the internet www.siaw.unisg.ch/lechner

white-collar workers are slightly over-represented among those not participating in rehabilitation and under-represented in EDUCATIONAL and SOCIAL rehabilitation. Unemployed long-term sick are most often found in EDUCATIONAL and SOCIAL measures and rarely in WORKPLACE rehabilitation. The health records indicate that previous long-term sickness and previous VR participation is often associated with participation in EDUCATIONAL rehabilitation. Furthermore, regional differences are substantial.

--------------------------------- Table 3.1 about here ---

Medical diagnosis at sickness registration is also revealing about the type of rehabilitation that often follows. Persons with alcohol or drug problems or with psychiatric disorder often participate in SOCIAL rehabilitation. Of particular importance are the results of the rehabilitation assessment. If the assessment is carried out by the employer WORKPLACE rehabilitation is the standard choice. On the other hand if executed by the insurance offices EDUCATIONAL training is more likely to follow. Cases were the rehabilitation assessment resulted in a 'wait and see' strategy differ significantly from those cases classified as in need of VR. Whereas the former usually either do not participate in rehabilitation or receive non-vocational measures, such as MEDICAL or SOCIAL rehabilitation, the latter are offered vocational training. Cases where medical factors had prevented participation in VR often receive MEDICAL rehabilitation.

Table 3.2 shows some of the variables measured at de-registration of the sickness spell or at the end of the reporting period, December 1994, respectively. The average (right-censored) sickness-spell length varies between 239 days for the NO rehabilitation group and 410 days among the participants in EDUCATIONAL rehabilitation. Whereas only 7% of all cases in NO rehabilitation remain unclosed in December 1994 this proportion is with 27% highest for the PASSIVE rehabilitation group. About 50% of the participants in NO or WORKPLACE rehabilitation return to their previous employer, while this share amounts to only 18% in the EDUCATIONAL rehabilitation group. In contrast, outflows to employment at a new workplace or at a sheltered (subsidised) workplace are very rare for all treatment groups except EDUCATIONAL rehabilitation, whose employment rate at new and sheltered workplaces combines to 22%. Outflows to unemployment vary between 8-17%, and between 10-20% of all cases terminate in temporary or permanent disability pensions (including temporary continued sickness benefit payments). Finally, about 10% leave to other destinations including schooling and education and out-of-labour force.

---------------------------------- Table 3.2 about here ---

These outflow destinations are summarised in two success measures: *Outflows to employment*, comprising returns to previous workplace and employment at a new workplace, and *Outflows to the labour force*, which include besides employment in regular jobs also employment at sheltered workplaces and outflows to unemployment. The unadjusted levels of these outcome variables (Table 3.2) indicate WORKPLACE rehabilitation as the most successful programme concerning re-employment and NO rehabilitation, besides WORKPLACE rehabilitation, as most favourable to re-integration in the labour force. PASSIVE and EDUCATIONAL rehabilitation are conspicuous by their low re-employment rates of only 27-29% compared to 50-52% of NO and WORKPLACE rehabilitation. MEDICAL and SOCIAL rehabilitation have somewhat higher re-integration rates yet fall short of the rates exhibited by NO and WORKPLACE rehabilitation. The difference between the re-employment rate and the rate of re-integration in the labour force is smallest for WORKPLACE rehabilitation, while the other measures re-integrate a substantial fraction into irregular employment and unemployment.

However, these numbers might be misleading, since they are not adjusted for the different compositions of characteristics between the treatment groups. Estimating causal treatment effects requires adjusting for these differences.

4 Nonparametric identification and estimation

4.1 Notation and definition of causal effects

A versatile nonparametric method for estimating causal treatment effects by adjusting for the differences in the covariate distributions among treatment groups is *propensity score matching*. Originally proposed for the evaluation of participation in a treatment versus non-participation by Rosenbaum and Rubin (1983)[9] it has been extended by Imbens (2000) and Lechner (2001) to the evaluation of policies that consist of a variety of different treatments.

Adopting the *potential outcomes* framework publicised by Rubin (1974), suppose an individual can choose between *M+1* different *treatments*. Enumerate by $\{Y_i^0, Y_i^1, ..., Y_i^M\}$ the potential after-treatment outcomes that an individual *i* could realise by corresponding treatment choice. For instance, if she participated in treatment 3 she would realise the outcome Y_i^3 and if she participated in treatment '0', which usually indicates the treatment 'not participating in any programme', she would realise the outcome Y_i^0. Let $S_i \in \{0,1,...,M\}$ indicate the treatment that individual *i* eventually receives. Then only the outcome $Y_i^{S_i}$ can *ex post* be observed, while the remaining M outcomes are *counterfactuals* that are unobservable by definition. Causal effects of treatments can now be considered as differences in the potential outcomes for the same person or a group of persons. Following Lechner (2001)[10] we define the average pair-wise treatment effects:

$$\gamma^{m,l} = E(Y^m - Y^l) = EY^m - EY^l; \tag{1}$$

$$\theta^{m,l} = E(Y^m - Y^l \mid S = m) = E(Y^m \mid S = m) - E(Y^l \mid S = m). \tag{2}$$

$\gamma^{m,l}$ denotes the difference in the outcome expected after participation in treatment m and the outcome expected after participation in treatment l for an individual drawn randomly from the population. Thus $\gamma^{m,l}$ quantifies by how much on average any individual would have been better off by participating in treatment m instead of participating in treatment l. On the other hand $\theta^{m,l}$ defines the causal effect for the sub-population of participants in treatment m (also called average treatment effect on the treated) and expresses by how much the participants in treatment m have been better off by *not* participating in treatment l. Obviously, the $\gamma^{m,l}$ effects are symmetric, i.e. $\gamma^{m,l} = -\gamma^{l,m}$, since they are defined for the same population. On the other hand $\theta^{m,l} \neq -\theta^{l,m}$ as they refer to different sub-populations.

To summarise the numerous pair-wise treatment effects more comprehensively Lechner (2001) suggested further to compute *composite treatment effects* γ^m and θ^m by averaging the pair-wise effects weighted by the number of participants in each treatment:

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9 For a recent application see Dehejia and Wahba (1999).

10 This section basically summarises results obtained in Lechner (2001, 2002a).

$$\gamma^m = \frac{\sum_{l \neq m}^{M} P(S=l) \cdot \gamma^{ml}}{1-P(S=m)} \quad = \quad E(Y^m) - \frac{\sum_{l \neq m}^{M} P(S=l) \cdot E(Y^l)}{1-P(S=m)}. \tag{3}$$

Treating the participant shares as given constants the last term can be defined as $E(Y^{-m})$ and the composite treatment effects expressed as

$$\gamma^m = E(Y^m - Y^{-m}) \qquad \text{and} \qquad \theta^m = E(Y^m \mid S=m) - E(Y^{-m} \mid S=m). \tag{4}$$

These composite measures provide the average effect of treatment *m* compared to a situation in which the individuals were randomly assigned to any of the other treatments with the probabilities valid in the population.

4.2 Identification and estimation of treatment effects

Since the counterfactual outcomes of, say participants in treatment *m*, can never be observed, they must somehow be estimated from the observed outcomes of individuals that participated in treatments other than *m*. The fundamental problem of evaluation is that individuals may select into a treatment on basis of factors that are related to their potential outcomes, such that the participants in treatment *m* might be systematically different from the participants in e.g. treatment *l*. If, however, all confounding variables that affect simultaneously treatment outcomes and treatment participation are observed and contained in *X*, then conditional on these *X* treatment selection is independent of all potential outcomes:

$$Y^0, Y^1, \ldots, Y^M \coprod S \mid X = x, \quad \forall x \in \chi. \tag{5}$$

This conditional independence assumption (CIA) allows to identify and estimate the pair-wise treatment effects $\gamma^{m,l}$ and $\theta^{m,l}$ by

$$\gamma^{m,l} \equiv \underset{X\in\tilde{X}}{E}\left(Y^m - Y^l\right) = \underset{X\in\tilde{X}}{E}\left(E[Y^m \mid X, S=m] - E[Y^l \mid X, S=l]\right)$$

$$\theta^{m,l} \equiv \underset{X\in\tilde{X}}{E}\left(Y^m - Y^l \mid S=m\right) = \underset{X\in\tilde{X}}{E}\left(E[Y^m \mid X, S=m] - E[Y^l \mid X, S=l] \middle| S=m\right),$$

since the observed outcome of treatment *l* for its participants $E[Y^l | X=x, S=l]$ is identical in expectation to the unobservable counterfactual outcome $E[Y^l | X=x, S=m]$ for participants in treatment *m* with the same characteristics *X*. With the inner expectation terms identified for each *X* through the observed outcomes of treatment participants, the outer expectation operator averages over these conditional-on-*X* treatment effects to obtain the population average effect.

However, the expected outcome $E[Y^l \mid X, S=l]$ can only be identified for those *X* that have a positive selection probability to treatment *l*, since otherwise Y^l could never be observed. Thus average treatment effects are only meaningful if they are defined with respect to the set of common support of *X* among participants in the treatments *m* and *l*. Since the common support for *m* and *l* would vary with each treatment effect, it is more convenient to restrict the definition of the treatment effects to the joint common support $\tilde{X}$, which contains only those *X* for which all *M+1* participation probabilities are strictly positive

$$\tilde{X} = \{x \mid P(S=l \mid X=x) > 0 \quad \forall l = 0,..,M\}.$$

Since nonparametric estimation of $E[Y^l \mid X, S=l]$ can be difficult if X is of high-dimension Rosenbaum and Rubin (1983) suggested for the case of a binary treatment balancing by the propensity to participate in treatment. Lechner (2001) and Imbens (2000) have shown that such a balancing score property of the participation probabilities also holds for the evaluation of multiple treatments with the expected counterfactual outcomes identified by

$$\begin{aligned} \underset{X \in \tilde{X}}{E}\left(Y^l \mid S=m\right) &= \underset{X \in \tilde{X}}{E}\left(E[Y^l \mid P^m(X), P^l(X), S=m] \mid S=m\right) \\ &= \underset{X \in \tilde{X}}{E}\left(E[Y^l \mid P^m(X), P^l(X), S=l] \mid S=m\right) \\ &= \underset{X \in \tilde{X}}{E}\left(E[Y^l \mid P^{m|m,l}(X), S=l] \mid S=m\right), \qquad (6) \end{aligned}$$

where $P^m(X) := P(S=m \mid X)$ and $P^{m|m,l}(X) := P(S=m \mid X, S \in \{m,l\})$.

A straightforward way to estimate $E[Y^l \mid P^m, P^l]$ or $E[Y^l \mid P^{m|m,l}]$ at the location (p^m, p^l) is nearest neighbour regression or *pair-matching*, which estimates $E[Y^l \mid p^m, p^l]$ by the observed outcome of that participant in treatment l whose participation probabilities (P^m, P^l) are closest to (p^m, p^l). In the treatment evaluation literature often nearest remaining neighbour regression or matching *without replacement* has been implemented where a control observation (participation in treatment l) is discarded from the sample once it has been matched. A matching algorithm that uses every control observation only once runs into problems in regions of the attribute space where the density of the probabilities is very low for the comparison group compared to the treatment group. Since in the pair-wise evaluation of multiple programmes comparison and control groups alternate this must occur by definition. An algorithm that allows using the same observation more than once (matching with replacement) does not have that problem as long as there is overlap in the distributions. Here pair-matching with replacement in the form suggested in Lechner (2001) and applied in Lechner (2002a) is implemented.

Furthermore, since the observations have not been sampled randomly, the matching estimator must be extended to take account of the sampling weight introduced in Section 3. With w_i the sampling weight of observation *i* corresponding to its local insurance office the average treatment effect on the treated is estimated as:

$$\hat{\theta}^{m,l} = \frac{\sum_i w_i \cdot \left(Y_i^m - Y_{(i)}^l\right)}{\sum_i w_i} \quad \forall i \text{ with } S_i = m \text{ and } X_i \in \tilde{X} , \qquad (7)$$

where $Y_{(i)}^l$ is the observed outcome of that individual of the treatment group *l* that is matched to observation *i*. The estimator $\hat{\theta}^{m,l}$ is a weighted average of the differences between the observed outcomes of the participants in treatment *m* and the observed outcomes of their matched counterparts in treatment *l*. Thus, the sampling weight of a participant in treatment *m* is also assigned to its matched counterpart. Analogously

$$\hat{\gamma}^{m,l} = \frac{\sum_i w_i \cdot \left(Y_{(i)}^m - Y_{(i)}^l\right)}{\sum_i w_i} \quad \forall i \text{ with } X_i \in \tilde{X}, \qquad (8)$$

where $Y_{(i)}^m$ and $Y_{(i)}^l$ are the observed outcomes of the individuals of treatment groups *m* and *l*, respectively, that are matched to the observation *i*. The match of treatment group *m* to observation *i* is defined as that participant in treatment group *m* whose Mahalanobis distance to

$\left[\hat{P}^m(X_i), \hat{P}^l(X_i), V(X_i)\right]$ is smallest, where $\hat{P}^m(X_i)$, $\hat{P}^l(X_i)$ are the estimated participation probabilities of observation *i* and $V(X_i)$ contains specific components of X_i that are deemed particularly important, like the recommendations of the physician and case worker in our case. Instead of matching on $P^{m|m,l}(X)$ we match on the two marginal probabilities $P^m(X)$, $P^l(X)$ as in the application in Lechner (2002a). The steps of the matching estimator are given in Table 4.1.

---------------------------------- Table 4.1 about here --

The joint common support $\tilde{X}$ is estimated by deriving for each treatment *m* the maximum and the minimum of the estimated participation probability $\hat{P}^m(X \mid S = s)$ in each treatment group *s*. Then the minimum of these maxima among all treatment groups *s* and the maximum of the minima are taken as the margins of the joint support for treatment *m*.[11] This procedure is repeated for each treatment *m*, which gives the estimated joint common support. Thereafter all observations are discarded, for which at least one participation probability lies above the minima of the maxima or below the maxima of the minima.

5 Results

In this study we compare all rehabilitative measures (including NO REHABILITATION) with each other. Notice that due to the non-availability of follow-up data only short-term effects (outflows out of sickness) can be measured. However, if rehabilitative measures had any positive effects on recovering lost working capacity, one would expect that this effect should become visible in increasing the number of outflows back to regular employment and into the labour force.

5.1 Estimation of the propensity scores

The first step of the matching estimator consists in estimating the participation probabilities for all 6 treatment types. Our basic results are based on the multinomial probit model (MNP, see Table 5.1), but we also discuss below how sensitive the evaluation results are to the choice of estimator for the propensity score. We also conduct a preliminary specification search to reduce the number of covariates.[12] Although being fully parametric, the multinomial probit model (MNP) is a flexible version of a discrete choice model, because it does not impose the **I**ndependence of **I**rrelevant **A**lternatives assumption, as for example does the multinomial logit model. However, with six categories the exact computation of the likelihood function is impossible. Therefore, we use simulated maximum likelihood based on the GHK simulator (Börsch-Supan and Hajivassiliou, 1993).

Since not all elements of the covariance matrix of the MNP model are identified and furthermore estimation with a very flexible covariance matrix can be numerically unstable, some elements of it need to be restricted to zero. A variety of models with different zero-restrictions on the Cholesky matrix have been estimated and finally a model with seven free Cholesky elements has been chosen (the results are not sensitive to the exact type of the covariance matrix as long as it provides enough flexibility). The implied covariances of the

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[11] It is assumed that the support of the conditional participation probability $P^m(X \mid S = s)$ is compact for all *m* and *s*.

[12] The specification search was based on binary probits of each treatment type compared to the group NO rehabilitation combined with score tests against omitted variables. This binary model corresponds to a multinomial probit with a diagonal covariance matrix.

error terms and the estimated coefficients for the MNP model with NO REHABILITATION as the reference group are presented in Table 5.1.

---------------------------------- Table 5.1 about here --

5.2 Matching

Before the matching proceeds the joint common support is estimated and all observations outside this support are discarded.[13] The matching estimator is implemented according to Table 4.1. For each combination of treatment types (*m, l*) observations of control group *l* are matched to group *m* according to their distance in the estimated participation probabilities $\hat{P}^m$, $\hat{P}^l$ and three dummy variables characterising the medical and non-medical VR recommendation.[14]

The success of the matching is inspected before proceeding to the estimation of the treatment effects. Poor match quality would indicate that the matched groups are not genuinely balanced on the observed characteristics and so that comparisons of outcomes based on these matches would not be justified. Table 5.2 provides the means of the variables *previously employed*, *musculoskeletal illness,* and *VR recommended* by medical or non-medical examination in all matched subgroups.[15] The shaded cells on the main diagonal give the mean in the treatment group (for the part belonging to the common support) and the off-diagonal elements provide the mean among the matched control observations, matched from treatment

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[13] The cut-off values of the estimated participation probabilities are provided in Table A5.2 in the appendix, and of the initially 6,287 observations 4,582 are retained as belonging to the joint common support.

[14] We attribute major importance to these three variables, but we nevertheless overweight the two participation probabilities in the Mahalanobis distance metric by a factor of 10, such that the other characteristics are not suppressed.

[15] Balancing has also been inspected for all other variables. No sizeable unbalances have been detected.

group *l* (column) to the treatment group *m* (row). If matching balances the covariates the entries in each *row* should not differ by much.

---------------------------------- Table 5.2 about here ---

With respect to the variables *previously employed* and *VR recommendations* the matching quality appears to be good. On the other hand, the matching algorithm is not that successful in balancing the incident of *musculoskeletal illness* when the comparison group is MEDICAL rehabilitation. Thus, the evaluation of MEDICAL rehabilitation might be somewhat biased. Nevertheless, with respect to the other treatment groups matching is successful here as well, which is reassuring since the vocational programmes WORKPLACE and EDUCATIONAL rehabilitation are of main interest in this paper. Alternatively, judging balancing by the estimated propensity scores leads to the same conclusions.

Since matching is performed with replacement, a control observation might be matched to many treated observations and it could happen that finally only a few control observations end up dominating the estimation results, thus increasing the variance of the estimator. Using concentration ratios as suggested by Lechner (2002a) to assess this problem, we find that compared to Lechner (2002a) they are rather high, particularly when matched to the individuals that did not participate in rehabilitation. This implies a considerable loss in precision, which will materialise in less significant estimated treatment effects. This, however, might be unavoidable, since the large NO rehabilitation group contains cases that are rarely represented in the other treatment groups.[16]

[16] Details are contained in Table A5.3 in the appendix.

5.3 *Effects of rehabilitation*

Table 5.3 shows the estimated pair-wise treatment effects for the total population $\gamma^{m,l} = E[Y^m - Y^l]$, while Table 5.4 contains the effects $\theta^{m,l} = E[Y^m - Y^l \mid S = m]$ for the participants in treatment *m*. The last column in each table gives the composite effects.[17]

---------------------------------- Table 5.3 about here ---

Concerning the outcome *outflows into employment*, Table 5.3 indicates that, compared to NO rehabilitation, PASSIVE, EDUCATIONAL, and MEDICAL rehabilitation reduced re-employment chances by about 12, 19, and 8%-points, respectively. Comparing the rehabilitative measures among each other, EDUCATIONAL rehabilitation worsened re-employment prospects by more than 10%-points relative to WORKPLACE, MEDICAL and SOCIAL rehabilitation. The composite effects in the last column of Table 5.3 also indicate that NO and WORKPLACE rehabilitation are clearly superior to the other programmes.

The average treatment effects on the treated (Table 5.4) are mostly insignificant. For the participants in NO rehabilitation, NO rehabilitation seems to be preferable to EDUCATIONAL and even to WORKPLACE rehabilitation, where the latter effect is significant only at the 10% level, though. However, the composite effects suggest that NO rehabilitation, followed by WORKPLACE rehabilitation, were most beneficial to re-employment chances. Again EDUCATIONAL and SOCIAL rehabilitation are amongst the least successful.

---------------------------------- Table 5.4 about here ---

[17] The variance of the pair-wise effects is estimated by its asymptotic approximation as in Lechner (2001), neglecting that the participation probabilities are estimated. This approximation turned out to be fairly accurate compared to bootstrap quantiles (see Lechner, 2002b). Variance estimates for the composite effects are not available.

Examining the effects between the different programmes, WORKPLACE rehabilitation significantly improved employment chances relative to PASSIVE, EDUCATIONAL and MEDICAL rehabilitation. This, however, is only true for the participants in WORKPLACE rehabilitation, whereas these effects are insignificant for the participants in other programmes.

With respect to the *outflows into the labour force,* the evaluation results are often insignificant. The significant estimates generally point to NO rehabilitation as being the most successful programme, at least compared to PASSIVE, WORKPLACE and MEDICAL rehabilitation. For the other rehabilitation programmes, no clear ranking emerges from the composite effects, in contrast to the outcome variable employment.

Summarising these results, NO rehabilitation appears superior to all other programmes, followed by WORKPLACE rehabilitation, at least as regards re-employment chances. With respect to the re-integration into the labour force, WORKPLACE rehabilitation appears to be almost as unsuccessful as EDUCATIONAL and other forms of rehabilitation, though.

However, these negative effects are at least partly caused by a prolongation of the sickness spell due to rehabilitation. The final outflow destination for the censored cases is unknown. To disentangle the effect of rehabilitation on the length of sickness from the effect on the outflow destination, additional evaluation results for specific sub-populations are considered.[18] These results indicate that the negative effects of PASSIVE, MEDICAL and WORKPLACE rehabilitation relative to NO rehabilitation, found in Tables 5.3 and 5.4, are to a large extent attributable to a prolongation of registered sickness due to rehabilitation. Reasons for this lengthening of registered sickness could be, apart from the time spent in rehabilitative meas-

[18] For detailed results see the appendix.

ures, bureaucratic delays or inertia in the rehabilitative process, particularly for PASSIVE rehabilitation.

The negative effects of EDUCATIONAL rehabilitation, on the other hand, are rather directly attributable to a deterioration of immediate employment chances because of rehabilitation. EDUCATIONAL rehabilitation appears to be a path towards unemployment and non-competitive employment. This negative effect may be caused by reduced job-search activity. Stigma effects might also contribute to a reduction in employment chances when participating in EDUCATIONAL rehabilitation, because the pool of participants in EDUCATIONAL rehabilitation contains a large proportion of cases with previous sick-leave and vocational rehabilitation (Table 3.1). These shares are substantially higher than for the other treatment groups. As these persons are more likely to become sick repeatedly in the future again, a potential employer will be reluctant to employ a person from the group of participants in EDUCATIONAL rehabilitation.

5.4 Sensitivity analysis

Three checks of the sensitivity of the presented results are considered in this section.[19] The first concerns the estimation of the participation probabilities. The second check relates to the need for informative data by analysing the change of the results when omitting important conditioning variables. As a third check it is examined how the evaluation results change if the sampling weight is neglected in (7) and (8).

With respect to the participation probabilities we contemplate additionally two different specifications: First, instead of using a MNP model we estimate a multinomial logit model

(MNL) and proceed as before. Second, we estimate the conditional choice probabilities $P^{m|m,l}(X)$ directly by 15 ($6\times5/2$) binary probits and match only on $P^{m|m,l}(X)$. In both cases all variables are included in each equation, i.e. *no* exclusion restrictions are imposed. Thus, neither the MNL nor the MNP nest each other, since exclusion restrictions are employed in the MNP model (see Table 5.1) and covariance restrictions are entailed in the MNL model. In this sense the matching on the conditional binary probit estimates is the most flexible since it does neither restrict the joint covariance matrix nor places exclusion restrictions on the variables. For a further discussion of these issues see Lechner (2002a).

The results based on the MNL model are very similar to the previous results in Tables 5.3 and 5.4. The evaluation results with respect to the matching on the conditional binary probits differ somewhat in magnitude, but the qualitative conclusions remain unchanged.[20] This is in line with the finding of Lechner (2002a) that the evaluation results seem not to be very sensitive to the specification of the probability model. Similarly in Lechner (2002b) the evaluation results appear not to be very sensitive to the specification of the MNP model and the number of free elements in the (Cholesky) covariance specification.[21]

The sensitivity checks for omitted variables are again based on estimates of a MNP model as in Table 5.1. We omit three different groups of variables. First, we omit variables related to

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[19] The detailed results for all three sensitivity checks can again be found in the appendix.

[20] Interestingly, the evaluation results with the binary probits are very similar to the naïve treatment effects, i.e. the unadjusted differences in the levels of the outcome variable. This is particularly striking for $\gamma^{m,l}$ and indicates that not much adjustment has taken place, perhaps because of imprecise estimates of the participation probabilities. Since many of the variables included in the binary probit models are insignificant, these introduce additional noise. This might lead to a considerable sampling variance of the estimated participation probabilities and hence matching may be less able to adjust for the differences in the distributions of the true participation probabilities.

initial sickness registration (sickness degree, diagnosis and registering institution at Position B in Figure 2.1). Compared to the Tables 5.3 and 5.4 the negative effects of PASSIVE and MEDICAL rehabilitation relative to NO rehabilitation are generally somewhat overestimated, while the negative effect of WORKPLACE rehabilitation with respect to labour force re-integration relative to NO rehabilitation is understated. Nevertheless, the overall conclusions remain largely unchanged by the omission of these variables.

Next, the variables related to the rehabilitation assessment (Position C in Figure 2.1), such as medical and non-medical recommendation and the occurrence of factors preventing VR, are omitted. This means that medical and non-medical recommendation are not only excluded from the MNP model but are also no longer used as additional matching variables. In this case the negative effects of PASSIVE and MEDICAL rehabilitation are further exaggerated. Again the positive effect of NO rehabilitation versus WORKPLACE rehabilitation on the participants in NO rehabilitation is understated.

Third, the variables pertaining to sickness registration (Position B) as well as those related to rehabilitation assessment (Position C) are omitted, resulting in even larger biases. The negative effects of PASSIVE and MEDICAL rehabilitation are very large (reaching up to -33%-points) and even exceed the naïve treatment effects. Also the positive treatment effects of WORKPLACE rehabilitation on its participants relative to PASSIVE and EDUCATIONAL rehabilitation are grossly overstated. These findings demonstrate the importance of informative data and comprehensive subjective opinions such as the medical and non-medical recommendation for the ability to adjust for the different characteristics. The previous simulations with

[21] Because the results did not change much with the MNL and the binary probit models, nested logit models, that are somewhat in the middle between binary models and MNL with respect to model flexibility, are not

relevant variables omitted have shown that without these variables the matching estimator is not able to adjust for the worse health and labour market situation of the participants in rehabilitation even *before* participation in rehabilitation.

Finally, when the sampling weight is neglected in the calculation of the means after matching, see equations (7) and (8), most significant effects remain largely unchanged, while the effects for EDUCATIONAL rehabilitation are generally estimated as being even more negative. Also the negative effects of PASSIVE rehabilitation on its participants and the negative effect of WORKPLACE rehabilitation for the participants in NO rehabilitation are underestimated.

5.5 Heterogeneity among sub-populations

We also investigate a variety of sub-populations to verify whether particular sub-populations react differently to rehabilitation.[22] Samples are differentiated for men and women, younger and older individuals, employed and unemployed, Swedish born, and also according to previous health status. The estimated effects vary only little between these subgroups and only few differences to the results of Tables 5.3 and 5.4 are found. Table 5.5 shows an excerpt of the estimation results for re-employment for the subgroup of previously employed and of age 46-55 years, respectively, with only the rows according to NO, WORKPLACE and EDUCATIONAL rehabilitation retained.

--------------------------------- Table 5.5 about here --

For the employed WORKPLACE and EDUCATIONAL rehabilitation emerge as even more unfavourable to re-employment, with a significant negative pair-wise treatment effect between

further examined.

[22] As before, the detailed numbers can be found in the appendix.

NO and WORKPLACE rehabilitation of 8%-points and between NO and EDUCATIONAL rehabilitation of about 24%-points. On the other hand, for the 46-55 years old WORKPLACE rehabilitation appears in a more favourable light, with large positive effects against PASSIVE, EDUCATIONAL and SOCIAL rehabilitation and a composite effect that comes closer to NO rehabilitation, albeit still being inferior. However, EDUCATIONAL rehabilitation seems to be particularly harmful for this age group with large negative treatment effects vis-à-vis NO and WORKPLACE rehabilitation and a large negative composite effect.

6 Conclusions

This study estimates the effects of rehabilitation programmes for long-term sick in western Sweden on the subsequent labour market outcomes. The various rehabilitative measures are grouped into no rehabilitation, passive rehabilitation, workplace rehabilitation, educational rehabilitation, medical rehabilitation, and social rehabilitation, and its effects on re-employment and re-integration in the labour force are estimated by non-parametric propensity score matching methods for multiple treatments. Average programme effects are estimated for the population as well as for sub-populations to detect effect heterogeneity.

The estimates for the population indicate that many rehabilitative measures decrease re-employment and re-integration chances compared to no rehabilitation. For the participants in workplace rehabilitation re-employment chances improve compared to all other rehabilitative measures, though no significant evidence is found that workplace rehabilitation boosts re-employment compared to no rehabilitation. In general, passive and educational rehabilitation performed worst. For most rehabilitative measures these negative effects seem to stem from a prolongation of the sickness spell due to participation in rehabilitation, whilst educational rehabilitation appears to reduce re-employment chances directly. These negative effects of rehabilitation might be explained by indirect costs or opportunity costs of the time spent in rehabilitation in the form of reduced job search activity, for example. Also stigma effects might contribute to the negative re-employment chances of educational rehabilitation, whose participants often have been repeatedly long-term sick.

The econometric matching methods, which are basically semi- or nonparametric and allow arbitrary individual effect heterogeneity, are attractive in the circumstances of this setting, because due to the excellent data available we can argue that selection is based on observables. The first step of the matching estimator gives – as a by-product – additional insights in the selection process itself. A variety of sensitivity analyses suggests that the results are not very sensitive to the specification of the participation probability model. However, informative data appears to be crucial for the consistency of the evaluation results, since omitting central variables as for instance the subjective recommendations of physician and case worker severely bias the results towards an exaggeration of the negative treatment effects of some rehabilitation programmes, particularly those that contain a larger fraction of cases that are difficult to rehabilitate.

The fact that many of the estimated treatment effects albeit non-negligible in size are insignificant indicates the need for future research investigating the finite sampling performance of more sophisticated nonparametric regression methods that might be more efficient than matching.

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Figure 2.1: The development of a sickness case over time

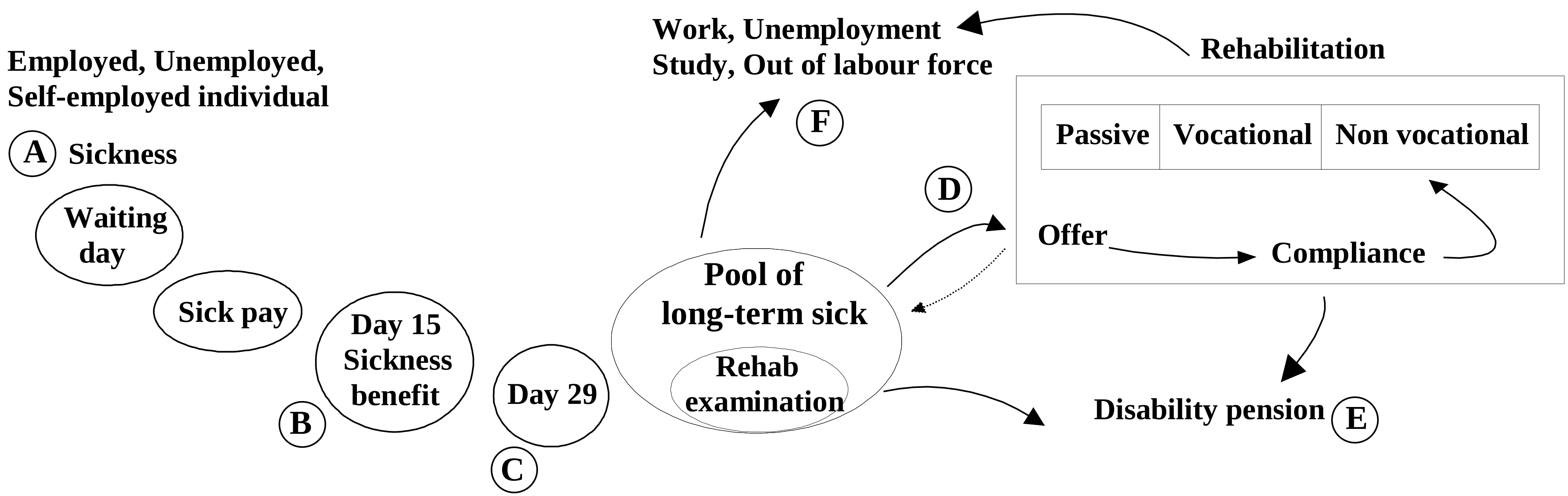

Table 3.1: Selected characteristics by treatment groups (means or shares in %)

Variable		None	Passive	Workpl.	Educat.	Medical	Social
Number of observations in group		**3200**	**302**	**1118**	**360**	**1108**	**199**
Age:	in years	40.9	41.2	39.6	39.1	40.6	39.9
Gender:	male	46	43	45	46	46	47
Labour market position:	white collar worker	26	20	20	16	22	15
Occupation in:	agriculture / others	31	31	26	34	31	43
Prior employment status:	unemployed	19	27	9	32	19	31
Previous sickness record	> 60 days in last 6 months	19	25	24	35	22	22
Previous participation in vocational rehabilitation		6	17	15	23	14	11
County:	Hallandslän	7	7	6	6	32	7
	Älvsborgslän	32	33	42	32	8	20
Community type:	rural and other	47	43	58	57	39	66
Position B: Beginning of sickness spell (sickness registration)							
Indications of alcohol or drug abuse		6	8	3	10	6	21
Diagnosis:	psychiatric	18	15	13	28	15	33
	Musculoskeletal	36	63	51	44	52	45
Position C: Investigation for the need of rehabilitation (rehabilitation assessment)							
Case assessed by:	employer	15	29	40	25	27	18
	insurance office	12	30	16	33	22	20
	not needed	39	7	10	9	16	20
Medical VR recommendation:	VR needed & defined	10	56	47	55	33	38
	eligible for disability pension	9	6	3	2	4	4
Non-medical VR recommend.:	VR needed & defined	12	64	63	62	37	45
	eligible for disability pension	8	3	1	1	3	4
Rehabilitation prevented by:	medical reasons	23	25	22	23	34	22

Note: Sample means in each treatment group multiplied by 100 (except age). See also Table A3.1 in the Appendix.

Table 3.2: End of sickness and the outcome variables by treatment groups (in % points)

Variable	None	Passive	Workpl.	Educat.	Medical	Social
Overall length of sickness spell (in days)	239	393	401	410	378	307
Case not closed (=still sick, right censored)	7	27	21	19	20	12
Return to previous workplace	49	25	49	18	39	39
Starts working at a new workplace	1	2	3	11	1	2
Works at a sheltered place	0	1	0	11	1	2
Leaves to unemployment	14	16	8	15	11	17
Disability pension or prolonged sickness benefit	16	20	10	16	18	17
Leaves to other outcomes (including education)	13	8	9	10	10	11
Employment [a)]	50	27	52	29	40	41
Labour force [b)]	64	44	61	56	52	59

Note: Sample means in each treatment group multiplied by 100 (except spell length).
a) Outflows to regular employment at closing day in %-points.
b) Outflows to labour force (regular employment, employment at sheltered workplaces, unemployment).

Table 4.1: The matching protocol

Step 1	Estimate a multinomial probit model to obtain $[\hat{P}^0(X), \hat{P}^1(X), ..., \hat{P}^5(X)]$.
Step 2	Estimate the joint common support and delete all observations that are not within.
Step 3	Estimate the conditional expectations appearing in equation **(6)** by matching as follows: For a given value of *m* and *l* the following steps are performed: a) Choose one observation in the subsample defined by participation in *m* and delete it temporarily. b) Find an observation in the subsample of participants in *l* that is as close as possible to the one chosen in step a) in terms of $[\hat{P}^m(X), \hat{P}^l(X), V]$. V may contain some components of X considered to be particularly important. Closeness is based on the Mahalanobis distance. Do not remove that observation, so that it can be used again. c) Repeat a) and b) until no participant in *m* is left. d) Using the matched comparison group formed in c), compute the respective conditional expectation by the *weighted* sample mean. Note that the same observations may appear more than once in that group.
Step 4	Repeat step 3 for all combinations of *m* and *l*.
Step 5	Check the quality of the matching performed in step 4.
Step 6	Compute the estimate of the treatment effects using the results of step 4 and compute their approximate covariance matrix (see Lechner, 2001).

Table 5.1: Results of the estimation of a multinomial probit model

Variable		Passive	Workplace	Education	Medical	Social
Constant		**-3.08**	**-2.53**	**-3.17**	**-2.18**	**-2.96**
Age	18-35 years	0	0.09	0.12	(0.04)	(0.05)
	46-55 years	0	**-0.17**	0	0	0
Gender (male)		0	-0.07	0	0	0
Citizen (Swedish born)		**-0.29**	(0.05)	*0.20*	-0.10	(0.05)
Widow / widower		0	**-0.56**	0	0	0
Occupation in	manufacturing	(-0.05)	(-0.01)	-0.13	(-0.04)	(-0.02)
	agriculture / others	0	0	0	0	**0.26**
Previous sickness record	31-60 days	0	0	0	**0.20**	0
	> 60 days	0	0	0	(-0.03)	0
Previous participation in vocational rehabilitation		0	**0.29**	**0.51**	**0.24**	0
Employed prior to sickness		**-0.32**	**0.45**	**-0.33**	(-0.06)	*-0.23*
Sickness benefit qualifying income		0	**0.18**	0	0	0
County:	Hallandslän	0	0	0	**1.68**	**0.74**
	Bohuslän	*-0.24*	**-0.25**	0	**0.69**	**0.70**
	Älvsborgslän	0	0	0	**-0.55**	0
	Göteborgskommun	(-0.09)	**-0.44**	**-0.45**	**1.19**	**0.83**
Urban / suburban region		0	**-0.24**	0	**-0.93**	**-1.12**
Major / middle large cities		0	(-0.16)	0	-0.11	**-0.82**
Industrial cities		0	0	0	**0.68**	0.21
Sickness regist. by psych. or social medicine centre		**0.37**	0	**0.51**	*0.19*	**0.48**
Sickness registration by private or others		0	0	0	0	-0.22
Sickness degree: 100%		(0.11)	**0.48**	**0.34**	(-0.04)	(-0.06)
Indications of alcohol or drug abuse		0	**-0.34**	0	0	**0.71**
Diagnosis:	psychiatric	0	0	0	0	**0.43**
	musculoskeletal	**0.50**	*0.12*	(0.07)	**0.39**	**0.53**
	injuries	(0.12)	*0.17*	(-0.01)	*0.16*	0.26
Rehabilitation needs assessed by:	employer	**0.54**	**0.62**	**0.43**	**0.37**	(0.09)
	insurance office	**0.53**	**0.31**	**0.60**	*0.18*	(0.04)
	IO on behalf of the employer	**0.62**	**0.47**	**0.51**	**0.34**	*0.30*
Assessment not needed		**-0.50**	**-0.43**	**-0.43**	**-0.32**	*-0.32*
Medical VR recommendation:	wait & see	**0.59**	**0.23**	*0.33*	**0.55**	(0.07)
	Rehabilitation needed	**1.82**	**1.28**	**1.29**	**1.09**	**0.99**
	eligible for disability pension	**0.61**	(-0.10)	(-0.26)	*0.32*	(-0.25)
Nonmedical VR recomm.:	Rehabilitation needed	**1.36**	**1.36**	**1.14**	**0.64**	**0.89**
	eligible for disability pension	0	0	0	**-0.37**	0
Medical factors prevented vocational rehabilitation		0	*-0.10*	0	**0.45**	0
Various other factors prevented VR		0	*-0.24*	0	**0.30**	0
Rehabilitation needed by both recommendations		**-0.95**	**-1.06**	**-0.56**	*-0.32*	**-0.73**

Table continued on next page.

Table 5.1: continued

	Implied covariance matrix of the error terms					
	None	Passive	Workplace	Education	Medical	Social
None	1.00	0	0.95	0	0.59	0
Passive		1.00	0.35	0	0	0
Workplace			2.02	-0.02	0.93	0
Education				1.00	-0.01	0
Medical					1.48	0.11
Social						1.01

Note: Simulated maximum likelihood estimates using the GHK simulator (800 draws in simulator for each observation and choice equation). *N* = 6287. Value of log-likelihood function: -6646. Coefficients of the category NONE are normalised to zero. 7 Cholesky factors are estimated to ensure that the covariance matrix of the error terms remains positive definite. Inference is based on the inverse Hessian. In the upper part of the table **bold** numbers indicate significance at the 1% level (2-sided test), numbers in *italics* relate to the 5% level, bracketed numbers () are insignificant at the 10% level. The basis reference category are the 36-45 year old unemployed without previous participation in vocational rehabilitation, living in Värmlandslän in a rural area. Their sickness case has been registered by a health care centre/hospital with circulation, respiratory, digestion or other diagnosis. No rehabilitation assessment has been carried out, the medical diagnosis has not been satisfactory and the non-medical diagnosis recommended a wait & see strategy and no factors prevented rehabilitation.

Table 5.2: Are the covariates balanced after matching?

l / *m*	None	Pass-ive	Work-place	Edu-cation	Med-ical	Social	None	Pass-ive	Work-place	Edu-cation	Med-ical	Social
	$\bar{X}^l$	$\bar{X}^l$	$\bar{X}^l$	$\bar{X}^l$	$\bar{X}^l$	$\bar{X}^l$	$\bar{X}^l$	$\bar{X}^l$	$\bar{X}^l$	$\bar{X}^l$	$\bar{X}^l$	$\bar{X}^l$
	Previously employed						Diagnosis: musculoskeletal problems					
None	0.79	0.84	0.81	0.86	0.76	0.81	0.43	0.43	0.51	0.40	0.53	0.46
Passive	0.76	0.76	0.82	0.79	0.73	0.73	0.58	0.62	0.62	0.60	0.66	0.68
Workplace	0.92	0.92	0.91	0.91	0.89	0.92	0.50	0.55	0.52	0.57	0.63	0.54
Education	0.69	0.73	0.75	0.70	0.70	0.74	0.38	0.45	0.44	0.45	0.55	0.44
Medical	0.80	0.71	0.85	0.80	0.80	0.76	0.51	0.50	0.60	0.51	0.56	0.49
Social	0.69	0.73	0.73	0.80	0.72	0.73	0.51	0.42	0.53	0.48	0.51	0.49
	Medical VR recommendation						Non-medical VR recommendation					
None	0.14	0.13	0.14	0.13	0.13	0.13	0.17	0.16	0.17	0.17	0.17	0.17
Passive	0.56	0.56	0.56	0.61	0.56	0.56	0.64	0.64	0.65	0.65	0.64	0.67
Workplace	0.48	0.49	0.48	0.49	0.49	0.48	0.63	0.63	0.63	0.64	0.63	0.63
Education	0.53	0.54	0.55	0.53	0.54	0.56	0.61	0.61	0.61	0.61	0.61	0.62
Medical	0.38	0.39	0.37	0.35	0.37	0.35	0.41	0.44	0.42	0.39	0.41	0.39
Social	0.39	0.40	0.41	0.40	0.39	0.38	0.48	0.46	0.48	0.53	0.46	0.46

Note: Matching balancing is exemplary examined for the covariates: Previously employed, musculoskeletal sickness, VR deemed necessary by physician, VR recommended by caseworker. The shaded figures on the main diagonal provide the mean of this variable in the respective subgroup (m). The off-diagonal elements give the mean among those observations of group (l) that are matched to the group (m) in the corresponding row. With successful balancing the numbers along each row should not differ very much.

Table 5.3: Estimated average treatment effects for the population ($\gamma^{m,l}$, in % points)

l / *m*	None	Passive	Workplace	Education	Medical	Social	Composite effect
				Employment			
None	(50)	*12.0*		**18.7**	7.8		11.2
Passive	*-12.0*	(27)					-11.3
Workplace			(52)	12.4			4.0
Education	**-18.7**		-12.4	(29)	-10.9	*-16.2*	-6.2
Medical	-7.8			10.9	(40)		-0.3
Social				*16.2*		(41)	-6.7
				Re-integration into labour force			
None	(64)	13.9	*12.5*		**13.9**		15.7
Passive	-13.9	(44)					-12.5
Workplace	*-12.5*		(61)				-1.6
Education				(56)			-2.9
Medical	**-13.9**				(52)		-4.5
Social						(59)	-1.5

Note: Absolute unadjusted levels on main diagonal (shaded, in brackets). The cells contain only entries if the effect is significant at the 10% level. Effects significant at the 5% level are given in *italics*, those significant at the 1% level are given in **bold** letters.

Table 5.4: Estimated average treatment effects for respective participants ($\theta^{m,l}$, in % points)

l / *m*	None	Passive	Workplace	Education	Medical	Social	Composite effect
				Employment			
None	(50)		14.3	**28.0**			11.1
Passive	*-17.0*	(27)					-10.9
Workplace		**16.2**	(52)	*15.1*	*11.6*		4.1
Education				(29)		-14.0	-5.6
Medical					(40)		0.0
Social						(41)	-7.6
				Re-integration into labour force			
None	(64)		**21.5**		*18.4*		15.3
Passive	*-19.3*	(44)					-12.2
Workplace			(61)		12.0		-1.3
Education				(56)			-2.9
Medical					(52)		-4.2
Social						(59)	-2.9

Note: See note below Table 5.3.

Table 5.5: Subgroup analysis for employed and older individuals ($\gamma^{m,l}$, % points)

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
	Previously employed – Outflows to employment						
None		*17.2*	8.1	**23.5**	10.2		15.1
Workplace	-8.1			15.4			2.7
Education	**-23.5**		-15.4			-19.7	-10.7
	Age 46-55 years – Outflows to employment						
None		**28.1**		**24.0**		*15.3*	16.5
Workplace		*28.9*		*24.7*		16.1	10.2
Education	**-24.0**		*-24.7*				-23.0

Note: The cells contain only entries if the effect is significant at the 10% level. Effects significant at the 5% level are given in *italics*, those significant at the 1% level are given in **bold** letters. The estimates for the previously employed are based on 5105 observations of which 3478 belonged to the common support, while the estimates for age 46-55 are based on 2354 observations with 1159 observations in the common support.

Appendices to:

A Microeconometric Evaluation of Rehabilitation of Long-term Sickness in Sweden

This appendix is made available directly

on the internet

www.siaw.unisg.ch/lechner

It is not going to be published

and is included

for the refereeing process only.

Appendices to:

A Microeconometric Evaluation of Rehabilitation of Long-term Sickness in Sweden

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Abstract

In this study the effects of various types of rehabilitation programmes on labour market outcomes are estimated. A main feature of this study is that it jointly evaluates multiple treatments by non-parametric matching estimators. The study is based on a large sample of persons in western Sweden who are long-term sick and could participate in rehabilitation programmes. Our results suggest that work-place training is superior to the other rehabilitation programmes with respect to labour market outcomes, but compared to non-participation no positive effects are found.

Keywords: Programme evaluation, matching, multiple treatments, multi-programme causal models, long-term sickness, vocational rehabilitation, Swedish labour markets.

JEL classification: C50, H43, I12, J26, J31

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Appendix to Section 3: Riks-LS Dataset

Variable definition and descriptive statistics

It follows a detailed description of the variables used in the order of occurrence in a sickness spell. The individual characteristics include information on age, gender, marital status and country of origin. The level of education and the individual labour market position is categorised into non-trained workers, trained blue collar workers, white collar workers and self-employed. The occupational sector has been aggregated to four classes: health care, natural and social sciences, manufacturing and machinery, agriculture and other services. The current employment status prior to sickness is coded as employed, participating in educational programmes, unemployed, other or unknown. The sickness benefit qualifying income as a proxy for earned income is recorded, as well as the resulting income loss due to sickness. The income qualifying sickness benefit is based on income during 12 months prior to the outbreak of sickness. The sickness benefit receivable at the event of sickness is equivalent to 80% of a maximum of 7.5 base amount.[1] The magnitude of income losses during a sick-leave period is derived as the difference between sickness qualifying income and the amount actually received. The past health record is documented by the length of past sick-leave in the last six months measured in days and by an indicator whether the individual had participated in vocational rehabilitation during the previous twelve month period. It is also known, whether the person already received sickness benefit or partial disability pension at the beginning of the current sickness spell. The latter is a sign that the individual had already been granted disability pension though has decided later on to re-enter the rehabilitation system. The former is a likely indication that the individual had received sickness benefit due to reduced partial work capacity for an extended period. A new sickness spell is then the consequence of a negative change in the degree of work capacity. Furthermore, for each sickness case the geographic location and time period is reported: County, community type, and local unemployment rate are documented. The sampling weight corresponding to the insurance office is also a proxy for the size of an insurance region or for the healthiness of its residents.

A variety of information is documented about the beginning of the current sickness spell. The institution of sick-leave registration is known and grouped into health care centre or hospital, psychiatric or social medicine centre, private or others. The initial degree of sick leave is meas-

[1] The base amount for the years 1991-1994 has been 3997, 4092, 3989 and 3995 EURO in January 1999 prices.

ured as full-time (100%), part time (25%, 50%, 75%) or unknown. Also, presence of drug or alcohol abuse and the main health diagnosis is reported: psychiatric, circulation, respiratory, digestion, musculoskeletal diseases, injuries and other diagnosis.

After about four weeks of prolonged sickness often an assessment of the need for rehabilitation is carried out. It is reported whether this assessment was carried out or whether it was not needed or not carried out. The organisation that carried out the assessment is recorded, namely the employer, the insurance office, or the insurance office on behalf of the employer. The recommendation emanating from the medical assessment could be: wait and see, rehabilitative measures needed and defined, possible or definite eligibility for disability pension, and diagnosis not satisfactory. In like manner the results from early non-medical assessment are described. A variable further indicates whether there were any medical or non-medical reasons (educational, private, family, social, economic, labour market, etc.) that prevented acceptance or completion of rehabilitative measures. A variety of logical combinations of the medical and non-medical recommendations have been constructed.

For individuals which participated in rehabilitation the rehabilitative measures received are documented and have been grouped into NO REHABILITATION, PASSIVE rehabilitation, WORKPLACE rehabilitation, EDUCATIONAL training, MEDICAL rehabilitation, and SOCIAL rehabilitation (see Section 2.2). Handling of cases receiving multiple measures is described further below.

At the end of the sickness case or the reporting period, the outflow destination is recorded for closed cases, while unclosed cases are right-censored and treated as still sick. The overall sickness spell length is known, though not very meaningful since it comprises the time before, during and after participation in rehabilitation and a decomposition is not feasible. The recorded outflow destinations for closed cases are: return to previous workplace, working at a new workplace, working at a sheltered workplace, leaves to education, leaves to unemployment, full or partial sickness benefit, full or partial disability pension, other outcomes. These outflows have been aggregated to two outcome variables: *Re-employment* and *re-integration in the labour force*.

In Table A3.1 descriptive statistics of all these variables are given. Column 2 contains the variable means for the original Riks-LS data set of 10,309 relevant observations in western Sweden. As described in Section 3.2 and further below a number of observations with missing information or aged above 55 have been dropped and this selected sample of 6,287 observations is represented in column three. Differences between these two samples are mainly due to the exclusion of older individuals for which vocational rehabilitation might be less sensible and intertwined with disability pension issues. Columns four to nine contain the decomposition of the selected sample of 6,287 observations into the six treatment groups, which has been the basis of the estimation of the multinomial probit model for the participation probabilities.

Due to the common support restriction of nonparametric identification, as explained in Section 4.2, the matching algorithm is performed only with those observations that lie in the common support of participation probabilities of all treatment groups. With respect to the estimated participation probabilities (Section 5.1), 4,582 observations fulfil this condition. Their descriptive statistics and its decomposition into the six treatment groups is presented in the columns 10 to 16. When comparing the selected sample and the observations in the common support, only a few striking dissimilarities can be found. The average sample weight has been reduced from 7.75 to 6.98 and the fraction living in rural areas has increased, while the urban and major cities retrenched. Regarding the rehabilitation assessment, the cases assessed by the insurance office have increased, while cases for which an assessment did not seem necessary decreased considerably among the untreated. Also cases with medical or non-medical assessment recommending rehabilitation expanded. Overall, these two samples appear similar and consequently the results of the matching estimator based on these common support observations are expected to hold alike for the selected sample of 6,287 individuals in western Sweden.

Table A3.1: Descriptive statistics of all variables by treatment groups (mean or share in %)

			Selected sample in Western Sweden							Observations in common support						
		All	All	None	Pass.	Work	Educa	Medic	Social	All	None	Pass.	Work	Educa	Medic	Social
Number of observations in group		10309	6287	3200	302	1118	360	1108	199	4582	2072	227	960	310	830	183
Position A: Background characteristics (Personality)																
Age	in years	44.4	40.5	40.9	41.2	39.6	39.1	40.6	39.9	40.4	40.6	41.0	39.9	39.5	40.6	40.1
Age:	18-35 years	26	32	31	28	34	37	31	32	32	32	31	33	35	31	32
	36-45 years	24	31	28	33	34	31	32	36	31	30	30	35	31	32	34
	46-55 years	29	37	41	39	31	32	37	32	37	39	40	32	34	37	34
	56-64 years	21	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Marital status:	married	55	52	53	48	53	45	53	43	51	51	50	53	46	53	44
	Unmarried	25	29	29	30	29	31	28	34	30	30	30	29	30	28	33
	Widow / widower	3	2	2	2	1	3	2	4	2	2	1	1	2	1	3
	Divorced	15	16	15	18	16	21	16	19	16	15	17	16	21	16	19
Gender:	male	46	45	46	43	45	46	46	47	47	48	46	44	48	45	46
Citizenship:	Swedish born	87	86	87	76	87	90	82	87	88	88	81	89	92	85	88
Education and employment:																
Labour market position:	blue collar, unskilled	45	45	41	47	52	47	47	49	47	43	51	52	49	47	51
	blue collar, skilled	19	20	19	22	23	23	20	18	21	21	20	23	21	20	18
	white collar worker	24	23	26	20	20	16	22	15	21	22	19	20	15	22	15
	self-employed	12	12	13	12	5	14	11	19	11	14	10	5	15	11	16
Occupation in:	health care	10	10	9	12	11	10	12	5	10	9	11	10	11	12	5
	Various sciences	27	28	31	22	25	25	25	23	25	26	22	24	23	24	24
	Manufacturing	31	32	29	35	38	32	32	29	33	31	35	38	31	31	30
	Agriculture / others	32	31	31	31	26	34	31	43	33	35	32	27	35	33	41
Prior employment status:	employed	81	81	81	73	91	68	81	69	81	79	76	91	70	80	73
	in education	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Unemployed	16	19	19	27	9	32	19	31	19	21	24	9	30	20	27
	other / unknown	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sickness benefit qualifying income (EUR) [a]		14921	15503	15491	15123	15906	15040	15526	14767	15443	15372	15147	15811	14921	15681	14744
Maximum payable sickness benefit (EUR) [b]		26368	26356	26356	26344	26368	26356	26356	26368	26356	26356	26356	26368	26356	26356	26368
Income loss (EUR) [c]		2965	3096	3084	2977	3131	3001	3155	2953	3084	3072	2953	3120	2989	3191	2953

Variable definition		All	All	None	Pass	Work	Educa	Medic	Social	All	None	Pass	Work	Educa	Medic	Social
Previous health and benefit record:																
Previous sick-	< 15 days	59	59	63	52	58	47	56	60	58	61	52	58	50	56	60
ness record	15-30 days	9	9	9	12	8	8	10	10	10	9	12	8	8	11	10
(days sick in	31-60 days	10	10	9	11	9	10	12	9	10	10	11	9	9	11	10
last 6 months):	> 60 days	21	22	19	25	24	35	22	22	22	20	25	24	33	22	20
	Unknown	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Previous participation in	no	89	89	94	83	85	77	86	89	89	92	84	86	81	87	89
Vocational rehabilitation	yes	8	11	6	17	15	23	14	11	11	8	16	14	19	13	11
(in last 12 months):	unknown	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Receiving sickness benefit before sickness		3	3	3	4	3	3	3	1	3	3	4	3	3	2	1
Receiving pension benefit before sickness		5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Not receiving sickness or pension benefits		92	97	97	96	97	96	96	98	97	97	96	97	97	98	99
Geographic location and time period:																
Sampling weight corresponding to IO		8.13	7.75	8.00	9.24	6.77	7.09	8.04	6.69	6.98	7.04	8.33	6.26	6.69	7.44	6.78
Local open unemployment rate (in %)		6.48	6.52	6.43	6.59	6.59	6.71	6.61	6.75	6.62	6.55	6.53	6.63	6.76	6.73	6.73
County:	Hallandslän	12	11	7	7	6	6	32	7	9	7	4	5	5	23	7
	Bohuslän	24	25	28	17	17	24	29	35	26	27	19	17	25	34	34
	Älvsborgslän	28	29	32	33	42	32	8	20	28	30	33	40	30	9	21
	Värmlandslän	24	23	23	25	29	29	17	29	27	26	28	31	32	20	30
	Göteborgskommun	12	11	11	19	6	8	14	9	10	10	16	7	8	13	8
Community type:	urban / suburban region	27	26	30	33	17	21	22	15	20	23	30	14	20	20	15
	major / middle large city	14	14	12	15	11	11	24	5	10	8	9	7	7	20	5
	Industrial city	12	12	10	9	14	11	16	14	14	14	11	16	12	13	14
	rural and other	46	49	47	43	58	57	39	66	56	55	51	63	61	47	66
Year of sickness	1991/92	32	29	29	26	30	29	29	31	30	29	28	30	27	31	32
registration:	1992/93	34	35	35	35	37	36	33	36	35	35	35	37	37	31	35
	1993/94	34	36	36	39	33	35	38	33	36	36	37	33	36	38	33
Position B: Beginning of sickness spell (sickness registration)																
Initial sickness registration by:																
health care centre / hospital		81	80	82	76	81	73	80	72	80	81	77	82	75	80	75
psychiatric / social medicine centre		7	8	7	9	6	14	8	20	9	9	8	6	14	10	16
by private or others		12	12	11	15	13	13	12	8	11	10	15	12	12	11	9

Variable definition		All	All	None	Pass	Work	Educa	Medic	Social	All	None	Pass	Work	Educa	Medic	Social
Sickness degree:	100% sick leave	86	86	84	86	92	91	86	86	88	87	88	91	89	86	86
	75% sick leave	1	1	1	1	1	1	2	2	1	1	1	1	2	2	2
	50% sick leave	10	10	12	11	6	7	10	10	9	10	10	6	8	10	9
	25% sick leave	3	2	3	1	2	1	3	3	2	2	2	2	1	2	3
	Unknown	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Indications of alcohol or drug abuse		5	6	6	8	3	10	6	21	6	6	9	3	10	6	17
Diagnosis:	psychiatric	16	18	18	15	13	28	15	33	19	20	16	13	27	17	31
	Circulation	6	4	5	1	4	3	3	0	3	4	1	4	3	3	0
	Respiratory	3	2	2	2	3	4	2	2	2	2	1	3	3	2	2
	Digestion	3	3	4	2	3	1	2	2	2	3	1	2	1	2	2
	Musculoskeletal	44	44	36	63	51	44	52	45	49	43	62	52	45	56	49
	Injuries	13	14	15	8	14	11	12	10	14	16	9	14	11	12	9
	Other	16	15	19	9	13	10	13	9	11	13	10	12	9	9	8
Position C: Investigation for the need of rehabilitation (rehabilitation assessment)																
Case assessed	by employer	20	23	15	29	40	25	27	18	26	19	30	39	25	28	19
	by insurance office	13	16	12	30	16	33	22	20	17	14	24	14	30	22	21
	IO on behalf of employer	10	11	7	15	14	13	17	15	13	10	15	15	14	20	16
	not needed	28	26	39	7	10	9	16	20	18	28	7	10	9	11	17
	not carried out	29	23	27	19	19	20	18	29	25	30	23	21	22	20	28
Medical VR	wait & see	52	55	64	34	40	37	57	48	55	68	35	39	39	55	48
recommendation:	VR needed & defined	20	26	10	56	47	55	33	38	31	14	56	48	53	37	38
	Eligible to disability pension	12	6	9	6	3	2	4	4	4	5	5	2	2	3	3
	not satisfactory / unclear	17	12	17	4	10	6	5	11	10	13	4	10	6	5	11
Non-medical VR	wait & see	53	63	80	33	36	37	60	51	59	78	32	36	38	56	51
recommendation:	VR needed & defined	24	32	12	64	63	62	37	45	37	17	64	63	61	41	46
	Eligible to disability pension	10	5	8	3	1	1	3	4	3	5	4	1	1	3	2
	not satisfactory / unclear	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rehabilitation	by medical reasons	22	25	23	25	22	23	34	22	26	25	26	21	23	35	21
prevented:	by various factors	5	6	5	8	5	10	8	11	6	6	8	4	10	8	11
	no factors prevented	72	69	72	67	73	67	58	67	68	69	67	74	66	57	68
Medical <u>and</u> non-medical recom.:	wait & see	37	45	58	18	22	24	45	35	43	60	16	20	25	41	34
	VR needed & defined	14	19	6	42	35	44	24	26	22	8	40	35	42	27	27
	Eligible to disability pension	7	3	5	2	1	0	1	2	1	2	2	0	0	1	1
	not satisfactory / unclear	6	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Variable definition	All	All	None	Pass	Work	Educa	Medic	Social	All	None	Pass	Work	Educa	Medic	Social
Medical or non-medical recomm.: wait & see	68	73	86	49	55	49	72	64	71	85	51	55	52	70	65
Rehab needed & defined	30	39	16	77	75	72	46	57	47	23	80	76	72	52	58
Eligible to disability pension	15	8	12	8	3	3	6	6	6	8	7	3	3	5	4
Not satisfactory / unclear	23	12	17	4	10	6	5	11	10	13	4	10	6	5	11
Medical and non-medical assessment differ	37	33	31	37	42	31	29	37	34	29	42	44	33	31	38
Position D: Rehabilitative measures received															
Passive Rehab (Evaluation of Work Capacity)	9	13	0	100	18	23	18	6	14	0	100	18	24	19	5
Work training at own workplace	5	7	0	0	31	0	6	0	7	0	0	31	0	7	0
Work training at a new workplace	12	15	0	0	72	0	14	0	17	0	0	72	0	15	0
Educational training	7	9	0	0	10	100	12	0	11	0	0	10	100	14	0
Medical rehabilitation	15	18	0	0	0	0	100	0	18	0	0	0	0	100	0
Social rehabilitation	1	1	0	0	0	3	0	20	1	0	0	0	3	0	15
Other rehabilitation	3	4	0	0	3	4	5	80	6	0	0	4	4	6	85
(Received multiple active measures)	6	8	0	0	13	7	31	0	9	0	0	13	7	33	0
Position E+F: End of sickness case (Outflows out of sickness)															
Overall length of sickness spell (in days)	288.3	311.7	239.1	392.9	401.1	410.3	377.9	307.4	325.8	247.9	392.7	405.2	408.5	388.8	312.3
Case not closed (=still sick, right censored)	9	14	7	28	21	19	20	12	15	9	26	19	19	22	15
a) Return to previous workplace	43	44	49	25	49	18	39	39	44	49	26	50	18	39	41
b) Starts working at a new workplace	2	2	1	2	3	11	1	2	2	1	2	3	12	1	2
c) Works at a sheltered place	1	1	0	1	0	11	1	2	1	0	1	1	12	1	1
d) Leaves to education	2	2	2	2	4	3	2	3	2	2	2	4	2	2	3
e) Leaves to unemployment	11	13	14	16	8	15	11	17	13	16	17	8	15	11	16
f) Full sickness benefit [d]	3	4	4	6	2	3	5	5	4	4	6	2	2	5	4
g) Partial sickness benefit [d]	2	3	2	3	3	5	4	4	3	2	4	4	5	4	4
h) Full disability pension	12	4	5	6	2	2	5	4	4	4	5	2	2	4	4
i) Partial disability pension	6	4	5	5	3	6	4	4	3	3	4	3	6	3	3
j) Leaves to other outcomes	9	9	11	6	5	7	8	8	8	9	7	5	6	7	6
Definition of outcome variables															
Returns to regular employment (a,b)	45	46	50	27	52	29	40	41	46	50	28	53	30	40	44
Joins back into the labour force (a,b,c,e)	56	60	64	44	61	56	52	59	61	66	46	62	58	53	60

Note: All monetary figures in January 1999 EUR, average CPI-deflator for 1991-1994 =(227.2*0.5+232.3+243.2+248.5*0.5)/3 = 237.8.

[a] Sickness based pay in EUR, as proxy for income.

[b] Maximum payable sickness benefit is equivalent to 80% of a maximum of 7.5 base amount.

[c] Income loss is defined as the difference between qualifying income level and receivable amounts of benefit at the event of sickness.

[d] These individuals are no longer sick (sickness case has been closed), but are granted continuous sickness benefit. This allows them income generating part-time work, averting them from turning to social security, on reduced salary levels.

[e] Prolonged Health status: Defined as one if during the six months following the last day of the sickness spell the individual had not a new sickness spell exceeding 30 days and had not been transferred to a permanent or temporary full disability pension.

Handling of cases with multiple treatments

There have been 536 cases that received more than one active measure. Since no reliable information is available to find out, whether these multiple measures were delivered at the same time or sequentially, nor to decide which of these measures has been the principal or the first, we assign them to the groups WORKPLACE, EDUCATIONAL, and MEDICAL rehabilitation in the following way, corresponding to our prior beliefs about, which is likely to be the first or principal of the rehabilitative measures received.[2]

Individuals receiving medical measures are assigned to the group MEDICAL rehabilitation (339 cases), since medical rehabilitation is of foremost urgency before any serious vocational rehabilitation could start. Cases with multiple measures not receiving medical rehabilitation but workplace rehabilitation are allocated to the group WORKPLACE rehabilitation (171 cases), since workplace rehabilitation is usually full-time while training or social measures operate alongside. Lastly, individuals not subject to medical rehabilitation or workplace rehabilitation but to EDUCATIONAL rehabilitation are allocated to the educational rehabilitation group (26 cases).

A closer look at the medical diagnosis indicates that the cases with multiple treatments often suffer from severe illnesses caused by multiple factors. Furthermore they show a longer overall sickness-spell length, giving support to the conjecture that to a substantial extent these multiple treatments were given sequentially. Deleting these individuals from the data set would bias the treatment effects upwards, since these difficult cases would not be included any longer. Thus, since the objectives of this evaluation study are treatment effects for the whole working population of age below 55 and not for a population consisting only of individuals easy to rehabilitate, these cases with multiple treatments must not be dropped from the sample.

Selection of sample

As mentioned previously we base our evaluation study on the 5 insurance offices of Hallandslän, Bohuslän, Älvsborgslän, Värmlandslän and Göteborgskommun in western Sweden. Since we want to address the effects of rehabilitative measures on the individuals who receive rehabilitation as a means to restore their work capacity and to re-enter the labour market, we drop a number of the 10,309 cases contained in the original data set. We exclude cases with missing data on the key outcome variables, aged above 55, or receiving partial or non-full time disability pension benefit already prior to the sickness spell. We furthermore delete those individuals being in education or with unclear occupation and cases for which either sickness degree, previous health record or previous participation in vocational rehabilitation are unknown. Finally we drop those cases where no vocational rehabilitation investigation has been carried out or where both medical and IO assessment decided that no vocational rehabilitation is needed. Thus, 6287 observations are retained, with 3200 cases not participating in any rehabilitative measure and 3087 cases receiving any form of rehabilitation.

Table A3.2: Selection of the sample

Cases deleted	# Cases deleted	# Cases remaining
Complete sample		**10309**
delete age > 55	2212	8097
delete cases receiving pension benefit before sickness	224	7873
delete cases where employment status is education	130	7743
delete cases where employment status is unclear	155	7588
delete cases where previous sickness history is unknown	156	7432
delete cases where previous participation in VR is unknown	155	7277
delete cases where the sickness degree is unknown	3	7274
delete cases where non-medical recommendation unclear/ not satisfactory	987	**6287**

[2] These beliefs have been informally confirmed by Mr. Sten Olsson at the Swedish National Insurance Board (Riksförsäkringsverket), Stockholm.

Appendix to Section 5

Estimation of participation probabilities

On the basis of the estimated coefficients of the multinomial probit model in Section 5.1 the individual participation probabilities are computed for all observations. The following table provides some descriptive statistics of the distributions of these probabilities in the various subgroups. The first row contains the 5%, 50% and 95% quantiles of the estimated participation probabilities in the whole population, whereas the following rows give these quantiles for the different treatment subsamples. The estimated quantiles exhibit a considerable variation of the estimated probabilities, indicating a considerably heterogeneity in their characteristics within each treatment group.

Table A5.1: Descriptive statistics for the distributions of the participation probabilities

	Quantiles of participation probabilities in % in each treatment group. (Groups *m* in rows)														
	Passive $P^2(X)$			Workplace $P^3(X)$			Education $P^4(X)$			Medical $P^5(X)$			Social $P^6(X)$		
Group *m*	5%	50%	95%	5%	50%	95%	5%	50%	95%	5%	50%	95%	5%	50%	95%
All	0.2	3	16	1	10	55	0.6	4	18	0.9	11	56	0.3	2	10
None	0.2	1	11	0.9	6	37	0.4	2	11	0.6	7	41	0.2	2	8
Passive	2	9	23	3	26	57	1	9	25	2	13	56	0.4	2	9
Workplace	1	6	16	6	34	65	1	7	20	2	10	48	0.4	3	9
Education	1	7	18	3	25	60	2	9	30	3	12	45	0.6	3	13
Medical	0.3	3	17	1	10	48	0.5	4	18	6	33	70	0.3	2	10
Social	0.4	4	13	0.5	15	52	0.9	6	22	3	16	52	1	5	23

	Correlation matrix of probabilities in full sample				
None	-0.65	-0.70	-0.62	-0.53	-0.30
Passive	1	0.49	0.58	0.09	0.15
Workplace		1	0.50	-0.14	0.04
Education			1	-0.01	0.26
Medical				1	0.12

Note: Quantiles of estimated participation probabilities. First row gives quantiles of the estimated probabilities among all observations, with the probability of non-participation omitted. The subsequent rows give the distribution of the estimated probabilities for each treatment group. The shaded cells thus correspond to the 'own' participation probability, i.e. the median probability to participate in workplace rehabilitation for the participants in workplace rehabilitation is 34%. The lower part of the table provides the correlation between the estimated participation probabilities among all observations. See also note below Table 5.1 (Estimation of the multinomial probit model).

The lower part of Table A5.1 shows the sample correlations among the estimated participation probabilities. These originate both from the estimated covariance matrix of the error terms (Table 5.1) and from the correlation among explanatory variables that influence individual choices.

While NO REHABILITATION is strongly negatively related to all other types of rehabilitation, the probabilities to participate in PASSIVE, WORKPLACE and EDUCATIONAL rehabilitation are markedly positive correlated. This indicates that the individuals that participate in NO REHABILITATION are systematically different from all others and that the participants of PASSIVE, WORKPLACE and EDUCATIONAL rehabilitation are more similar.

Estimation of global common support

As described in Section 4.2 the global common support is limited by the minima of the maxima and the maxima of the minima of the estimated participation probabilities, see Table A5.2.

Table A5.2: Margins of the common support

	$\hat{P}^1(X)$	$\hat{P}^2(X)$	$\hat{P}^3(X)$	$\hat{P}^4(X)$	$\hat{P}^5(X)$	$\hat{P}^6(X)$
Maximum						
None	98	34	70	58	88	31
Passive	93	35	70	58	78	26
Workplace	95	24	76	44	78	31
Education	91	24	72	52	81	31
Medical	99	31	74	37	89	29
Social	90	20	71	31	76	49
Minimum of Maxima	**90**	**20**	**70**	**31**	**76**	**26**
Minimum						
None	3	0	0	0	0	0
Passive	2	0	0	0	0	0
Workplace	0	0	0	0	0	0
Education	1	0	0	1	0	0
Medical	1	0	0	0	0	0
Social	2	0	0	1	1	1
Maximum of Minima	**3**	**0**	**0**	**1**	**1**	**1**

Note: Estimated Probabilities in %.

For instance, among the individuals, which did participate in workplace rehabilitation, the maximum of the estimated probabilities to participate in NO REHABILITATION was 95%, while the minimum was below 0.5%. The minimum of the maxima of the estimated participation probabilities for NO REHABILITATION among the six treatment groups was 90% and the maximum of the minima was 3%. All observations with estimated participation probability for NO REHABILITATION above 90% or below 3% were deleted. Accordingly only observations with estimated participation probabilities $\hat{P}^1 \in \{0.03,..,0.90\}$ and $\hat{P}^2 \in \{0,..,0.20\}$ and $\hat{P}^3 \in \{0,..,0.70\}$ and

$\hat{P}^4 \in \{0.01,..,0.31\}$ and $\hat{P}^5 \in \{0.01,..,0.76\}$ and $\hat{P}^6 \in \{0.01,..,0.26\}$ were retained and used for the matching estimator, which were 4582 out of the 6287 selected cases. The descriptive statistics of the remaining 'common support' sample are given in columns 10-16 of Table A3.1.

Matching quality

In matching with replacement a control observation can be matched many times to different treated observations such that a few control observations might dominate the estimation result, increasing the variance of the estimator. Table A5.3 inspects the gravity of this issue, showing the dominance of the 10% largest weights among all weights (Lechner, 2002a). It is a concentration ratio computed as the sum of weights in the first decile of the weight distribution. Each weight equals the number of treated observations to which the specific control observation is matched to, adjusted by the sampling weights of the treated observations. These weights are divided by the total sum of weights in the comparison sample.

Table A5.3: Excess use of single observations in %

l / m	None	Passive	Workplace	Education	Medical	Social
None		60	48	58	44	48
Passive	24		29	29	29	40
Workplace	29	28		32	31	36
Education	27	30	31		26	32
Medical	33	52	36	53		55
Social	26	31	29	30	28	

Note: Share of the sum of largest 10% of weights of total sum of weights.

Censoring of sickness cases

The negative treatment effects of rehabilitation found in Tables 5.3 and 5.4 are to a large extent due to a prolongation of the sickness spell through rehabilitation, as indicated by the shares of sickness cases which terminated within the reporting period (July 1991 till December 1994), given in Table 3.2. Whereas 93% of all sickness cases in NO REHABILITATION were closed before December 1994, this was the case for only 73% of the participants in PASSIVE rehabilitation. Due to the data collection scheme the remaining 27% cases in passive rehabilitation are right-censored and their final outflow destination is unknown. Estimating the effects of rehabilitation on the probability that a sickness case ends before December 1994 (Table A5.4) it can be seen, that among the rehabilitative measures no significant differences are found. However, a participant in NO REHABILITATION is significantly more likely to terminate his sickness within the reporting period than had he participated in PASSIVE, WORKPLACE or MEDICAL rehabilitation. Interestingly, the significant effects are of similar magnitude than the treatment effects on the re-employment and re-integration outcomes, suggesting that the negative employment effects of PASSIVE, WORKPLACE and MEDICAL rehabilitation compared to NO REHABILITATION are mainly due to a 10-20%-points increased probability of exhausting the data collection period. Thus it seems that rehabilitative measures extend the sickness spell substantially compared to no rehabilitation.

Table A5.4: Evaluation results for the whole population ($\gamma^{m,l}$ and $\theta^{m,l}$, in % points)

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
	Sickness terminated within reporting period (=not right-censored), $\gamma_0^{m,l}$ effects						
None	(93)	14.9	*11.8*		*10.6*		12.0
Passive	-14.9	(73)					-9.3
Workplace	*-11.8*		(82)				-2.6
Education				(81)			-1.1
Medical	*-10.6*				(80)		-6.4
Social						(85)	-0.2
	Sickness terminated within reporting period (=not right-censored), $\theta_0^{m,l}$ effects						
None	(93)		*18.0*				11.8
Passive	-16.3	(73)					-9.0
Workplace			(82)				-2.3
Education				(81)			-0.8
Medical	-11.6				(80)		-6.2
Social						(85)	-1.2

Note: Absolute unadjusted levels on main diagonal (shaded, in brackets). The cells contain only entries if the effect is significant at the 10% level. Effects significant at the 5% level are given in *italics*, those significant at the 1% level are given in **bold** letters.

For disentangling the effects of rehabilitation on the length of sickness from the effects on the outflow destination after termination of the sickness, the treatment effects are also estimated for two specific sub-populations: All sickness cases that were registered in the period July 1991 until June 1993 and all sickness cases that were closed in the data collection period. While the former sub-population includes only cases with at least 18 months to recover before right-censoring, the latter includes only cases for which the outflow destination is observed.

Table A5.5: Subgroup analysis for sickness cases registered in July 1991 - June 1993 (%-points)

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
$\gamma^{m,l}$ effects			Employment				
None	(52)	*14.6*		*17.9*	**15.3**		16.1
Passive	*-14.6*	(30)					-16.5
Workplace			(53)				4.7
Education	*-17.9*			(31)		-16.8	-5.7
Medical	**-15.3**				(40)	-14.1	-4.8
Social				16.8	14.1	(45)	-2.8
			Re-integration into labour force				
None	(65)	13.2	*13.1*		**18.1**		14.9
Passive	-13.2	(50)					-13.5
Workplace	*-13.1*		(64)				-0.9
Education				(61)			2.3
Medical	**-18.1**				(54)		-12.0
Social						(68)	5.1
			Sickness terminated within reporting period (=not right-censored)				
None	(97)		11.4		*12.4*		10.1
Passive		(83)					-6.5
Workplace	-11.4		(87)				-4.1
Education				(91)			4.6
Medical	*-12.4*				(87)		-5.9
Social						(96)	4.5
$\theta^{m,l}$ effects			Employment				
None	(52)	*19.1*	*19.4*	*22.1*	**25.3**		16.0
Passive	**-29.0**	(30)					-16.0
Workplace		**21.0**	(53)	14.5	*15.6*		5.0
Education				(31)			-5.0
Medical				21.2	(40)		-4.2
Social						(45)	-5.2
			Re-integration into labour force				
None	(65)		*21.1*		**26.7**		14.7
Passive	-22.6	(50)					-13.1
Workplace		14.3	(64)		12.5		-0.4
Education				(61)			2.3
Medical	*-17.2*				(54)		-11.3
Social						(68)	2.4
			Sickness terminated within reporting period (=not right-censored)				
None	(97)						10.0
Passive		(83)					-6.1
Workplace			(87)				-3.7
Education				(91)			4.6
Medical					(87)		-5.4
Social						(96)	2.7

Note: Absolute unadjusted levels on main diagonal (shaded, in brackets). The cells contain only entries if the effect is significant at the 10% level. Effects significant at the 5% level are given in *italics*, those significant at the 1% level are given in **bold** letters. Estimates are based on 4043 observations with 2615 observations in the common support.

The estimation results for the sub-population of cases registered before July 1993 are given in Table A5.5 and are similar to those for the whole population (Tables 5.3 and 5.4). Although the share of closed cases increased to 83-96% for the various rehabilitative measures, the probability of sickness termination within reporting period is still significantly reduced for PASSIVE, WORKPLACE and MEDICAL rehabilitation. EDUCATIONAL and SOCIAL rehabilitation appear in a somewhat more favourable light with a positive composite effect on sickness termination before end of 1994 and on re-integration in the labour force. However these effects do not transform into re-employment, where WORKPLACE rehabilitation continues to be the most successful among the rehabilitative measures. Nevertheless, NO REHABILITATION remains dominant with respect to all three outcome variables.

For the sub-population of closed cases (Table A5.6), it is striking that all estimated treatment effects with respect to outflows to the labour force are insignificant. Concerning re-employment the previously negative treatment effects of the rehabilitative measures compared to NO REHABILITATION have mostly vanished. Overall WORKPLACE rehabilitation seems even to increase re-employment chances compared to NO REHABILITATION. And compared to EDUCATIONAL rehabilitation WORKPLACE rehabilitation demonstrates a strong positive effect of almost 20%-points.

Table A.5.6: Subgroup analysis for closed cases ($\gamma^{m,l}$ and $\theta^{m,l}$ in %-points)

l / *m*	None	Passive	Workplace	Education	Medical	Social	Composite effect
$\gamma^{m,l}$ effects				Employment			
None				*16.5*			6.4
Passive							-13.5
Workplace							7.1
Education	*-16.5*					-16.3	-9.2
Medical							2.9
Social				16.3			-5.5
$\theta^{m,l}$ effects				Employment			
None				21.8			6.4
Passive	*-20.1*						-13.3
Workplace		**21.2**		**19.4**			7.2
Education					-17.4		-8.6
Medical							3.0
Social							-6.1

Note: See Note below Table A5.4. The estimates are based on 5443 observations with 3796 observations in the common support. Effects for the outcome variable *outflows to the labour force* were all insignificant.

It should however be recalled that this sub-population of closed cases is endogenously selected, in the sense that individuals for whom the treatment prolonged the duration of sickness are undersampled, whereas individuals for whom the treatment reduced the duration of the sickness spell are oversampled. Thus sample selection is performed on an endogenous variable. Nevertheless, these results help to understand the reasons behind the size of the estimated effects.

Taken together, it seems that prolongation of registered sickness due to rehabilitation is at least to some extent causing the negative treatment effects of PASSIVE, MEDICAL and vocational WORKPLACE rehabilitation of Tables 5.3 and 5.4. On the other hand, EDUCATIONAL rehabilitation appears not to prolong registered sickness significantly, but rather reduces re-employment chances, leading to unemployment and non-competitive employment.

Sensitivity analysis

Three kinds of analyses to assess the sensitivity of the estimated treated effects are considered here. The first concerns the estimation of the participation probabilities (Tables A5.7 to A5.9). The second concerns the need for informative data and verifies how results change if important variables are omitted (Tables A5.10 to A5.12). The third sensitivity analysis examines how estimated treatment effects change if the sampling probabilities according to the particular sampling scheme are neglected (Table A5.13). All estimates are based on the same 'common support sample' of 4582 observations, as described in Table A3.1.

Sensitivity of the treatment effects with respect to the participation probability model is assessed in Tables A5.7 and A5.8. Table A5.9 provides for comparison purposes the naïve treatment effects, i.e. the unadjusted differences in the levels of the outcome variable corresponding to Table 3.2. In Table A5.7 the matching is based on $P^m(X), P^l(X)$ estimated by a multinomial logit model (MNL) without exclusion restrictions, whereas in Table A5.8 it is based instead on the conditional participation probabilities $P^{m|m,l}(X)$, which are estimated by binary probit models for each (*m*,*l*) combination.

Table A.5.7: Evaluation results with MNL probability model ($\gamma^{m,l}$ and $\theta^{m,l}$ in %-points)

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
$\gamma^{m,l}$				Employment			
None		*12.4*		**19.0**			9.0
Passive	*-12.4*						-14.9
Workplace				*16.5*			3.7
Education	**-19.0**		*-16.5*		*-13.0*	-14.2	-9.0
Medical				*13.0*			1.4
Social				14.2			-4.2
				Re-integration into labour force			
None		12.7	9.9		*11.6*		14.3
Passive	-12.7						-13.4
Workplace	-9.9						-2.9
Education							0.1
Medical	*-11.6*						-2.3
Social							-0.8
$\theta^{m,l}$				Employment			
None				**27.9**			8.7
Passive	-16.5		*-20.3*		-14.8		-14.6
Workplace		**14.7**		**16.1**	10.3		3.6
Education						*-18.0*	-8.5
Medical				*18.7*			1.4
Social							-4.4
				Re-integration into labour force			
None			*18.3*		*16.5*		13.9
Passive	-17.5			-21.7			-13.2
Workplace							-2.8
Education							0.2
Medical							-2.1
Social							-1.7

Note: Propensity scores estimated with multinomial logit model without exclusion restrictions, i.e. all variables are included in each equation.

Table A.5.8: Evaluation results with conditional binary probit estimates ($\gamma^{m,l}$, $\theta^{m,l}$ in %-points)

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
$\gamma^{m,l}$				Employment			
None		**18.5**		**18.4**			7.3
Passive	**-18.5**		**-22.8**		*-13.3*	*-13.9*	-12.3
Workplace		**22.8**		**22.7**	*9.5*		9.4
Education	**-18.4**		**-22.7**		*-13.2*	*-13.9*	-12.3
Medical		*13.3*	*-9.5*	*13.2*			-1.8
Social		*13.9*		*13.9*			-3.5
				Re-integration into labour force			
None		*16.2*			**10.4**		10.6
Passive	*-16.2*						-15.2
Workplace							1.5
Education							-3.4
Medical	**-10.4**						-7.1
Social							-0.2
$\theta^{m,l}$				Employment			
None		**27.7**		**24.0**		12.2	7.1
Passive			**-22.8**		*-19.0*	*-22.2*	-11.8
Workplace		**15.7**		**21.4**	**16.0**		10.0
Education	-14.6		**-21.6**				-11.7
Medical		**18.5**	*-11.1*	*20.2*			-1.7
Social		14.3					-3.6
				Re-integration into labour force			
None					*12.3*		10.3
Passive	**-25.9**		-17.4				-14.8
Workplace							1.5
Education							-3.3
Medical			-9.8				-6.8
Social		18.6					-1.4

Note: Conditional participation probabilities estimated by probits without exclusion restrictions. I.e. in each equation all variables are included.

Table A.5.9: Naïve treatment effects: differences between outcome levels (%-points)

l / m	None	Passive	Workplace	Education	Medical	Social
				Employment		
None	(50)	23	-2	21	10	9
Passive		(27)	-25	-2	-13	-14
Workplace			(52)	23	12	11
Education				(29)	-11	-12
Medical					(40)	-1
Social						(41)

Note: Naïve treatment effects: Unadjusted differences between the re-employment rates of the different treatment groups.

In a second sensitivity analysis it is assessed whether the matching estimator would have produced biased treatment effect estimates if only less informative data were available. Tables A5.10 to 5.12 demonstrate how the evaluation results change if relevant variables are omitted as described in Section 5.4.

Table A.5.10: Omitting the variables related to initial sickness registration ($\gamma^{m,l}$ and $\theta^{m,l}$)

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
$\gamma^{m,l}$				Employment			
None		**16.0**		**16.7**	**10.9**		12.6
Passive	**-16.0**		*-14.7*			*-15.5*	-9.5
Workplace		*14.7*		*15.5*	9.6		6.0
Education	**-16.7**		*-15.5*			*-16.2*	-8.3
Medical	**-10.9**		-9.6			-10.4	-0.8
Social		*15.5*		*16.2*	10.4		0.1
				Re-integration into labour force			
None		*16.4*	8.5		**14.1**		14.1
Passive	*-16.4*						-12.8
Workplace	-8.5						-0.1
Education							-1.9
Medical	**-14.1**						-5.4
Social							5.0
$\theta^{m,l}$				Employment			
None		*22.2*		**27.2**	**19.0**		12.6
Passive			*-18.1*				-9.0
Workplace		**17.3**		*11.8*	*11.8*		6.1
Education						-14.9	-7.7
Medical		15.2		16.0			-0.3
Social							-1.8
				Re-integration into labour force			
None		*22.8*	*15.2*		**21.6**		14.0
Passive	*-18.9*		-17.5				-12.3
Workplace							0.2
Education							-1.8
Medical							-4.9
Social							2.8

Note: Matching based on participation probabilities estimated by MNP model as in Table 5.1 but with the variables related to initial sickness registration (sickness degree, diagnosis, indications of alcohol or drug abuse, and institution that registered the sickness) excluded.

Table A.5.11: Omitting the variables related to rehabilitation assessment ($\gamma^{m,l}$ and $\theta^{m,l}$)

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
$\gamma^{m,l}$				Employment			
None		**19.8**		**19.8**	**11.2**		11.2
Passive	**-19.8**		**-14.8**		-8.6	*-16.0*	-14.5
Workplace		**14.8**		**14.9**			1.3
Education	**-19.8**		**-14.9**		-8.7	*-16.1*	-10.8
Medical	**-11.2**	8.6		8.7			-2.5
Social		*16.0*		*16.1*			-0.4
				Re-integration into labour force			
None		**19.3**	*10.1*	*11.1*	**16.3**		15.3
Passive	**-19.3**						-15.7
Workplace	*-10.1*						-2.5
Education	*-11.1*						-2.3
Medical	**-16.3**						-7.7
Social							1.0
$\theta^{m,l}$				Employment			
None		**24.9**	8.8	**21.2**	**13.0**		11.0
Passive	**-21.2**		*-18.1*				-13.9
Workplace		**16.3**		**19.5**	10.2		1.4
Education	*-16.2*		-14.8			-14.7	-10.2
Medical				16.9			-2.2
Social							-1.7
				Re-integration into labour force			
None		**24.9**	**15.9**	*15.4*	**20.6**		14.9
Passive	**-25.6**		-15.6				-15.3
Workplace	*-10.2*				9.7		-2.4
Education							-2.1
Medical	*-13.2*						-7.3
Social							-0.8

Note: Matching based on participation probabilities estimated by MNP model as in Table 5.1 but with the variables related to rehabilitation assessment (medical and non-medical recommendation, the institution that carried out the rehabilitation assessment and the occurrence of medical or non-medical factors preventing rehabilitation) excluded.

Table A.5.12: Omitting variables related to sickness registration and rehabilitation assessment

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
$\gamma^{m,l}$				Employment			
None		**24.5**		**20.9**	**12.4**		13.3
Passive	**-24.5**		**-18.0**		*-12.1*	**-23.9**	-17.1
Workplace		**18.0**		*14.4*			3.6
Education	**-20.9**		*-14.4*			**-20.3**	-9.7
Medical	**-12.4**	*12.1*				*-11.8*	-4.2
Social		**23.9**		**20.3**	11.8		-3.5
				Re-integration into labour force			
None		**24.0**	*11.0*	11.9	**19.0**		16.3
Passive	**-24.0**		*-13.0*			**-22.6**	-20.0
Workplace	*-11.0*	*13.0*					-1.8
Education	-11.9						-0.5
Medical	**-19.0**					*-17.6*	-9.5
Social		**22.6**			*17.6*		-1.2
$\theta^{m,l}$				Employment			
None		**29.5**	*10.7*	**23.7**	**16.9**		13.3
Passive	**-26.1**		*-21.5*				-16.3
Workplace		**25.5**		**22.1**			3.9
Education	-13.6					-13.5	-9.0
Medical	-10.2	*18.2*					-3.7
Social	-14.8						-5.6
				Re-integration into labour force			
None		**27.3**	**15.3**	13.5	**26.5**		16.2
Passive	**-32.9**		*-22.3*			-20.7	-19.2
Workplace		*16.7*					-1.4
Education							-0.1
Medical	**-17.2**						-8.7
Social	-16.5						-4.4

Note: Matching based on participation probabilities estimated by MNP model as in Table 5.1 but with the variables related to initial sickness registration (sickness degree, diagnosis, indications of alcohol or drug abuse, and institution that registered the sickness) *and* the variables related to rehabilitation assessment (medical and non-medical recommendation, the institution that carried out the rehabilitation assessment and the occurrence of medical or non-medical factors preventing rehabilitation) excluded.

Finally, as a third sensitivity analysis Table A5.13 provides the evaluation results when the sampling weights w_i are neglected in the calculation of the treatment effects (7) and (8).

Table A.5.13: Evaluation results ignoring the sampling weight ($\gamma^{m,l}$, $\theta^{m,l}$, in % points)

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
				Employment			
None		*11.8*		**20.1**	*8.8*		12.5
Passive	*-11.8*						-10.2
Workplace				**16.1**			5.9
Education	**-20.1**		**-16.1**		*-11.3*	**-19.5**	-7.3
Medical	*-8.8*			*11.3*			-1.2
Social				**19.5**			4.1
				Re-integration into labour force			
None		*13.3*	**11.9**	8.5	**15.4**		16.4
Passive	*-13.3*						-8.2
Workplace	**-11.9**						-0.6
Education	-8.5						-0.6
Medical	**-15.4**					-10.2	-4.3
Social					10.2		3.8
$\theta^{m,l}$				Employment			
None			*10.2*	**29.2**	*11.7*		12.5
Passive	*-12.8*		*-10.6*				-9.8
Workplace		**16.8**		**14.3**	**13.0**		6.1
Education			*-10.0*			-12.3	-6.5
Medical				12.0			-0.8
Social							2.6
				Re-integration into labour force			
None			**17.3**	*15.9*	**17.3**		16.0
Passive	*-12.8*					-12.8	-7.9
Workplace	-6.4				**14.0**		-0.3
Education					8.7		-0.5
Medical	-6.5						-3.8
Social							1.9

Subgroup analysis

To assess treatment effect heterogeneity among sub-populations the estimated effects for a variety of subgroups are presented in the subsequent tables. For the estimation of these subgroup treatment effects the participation probabilities estimated in Section 5.1 for the whole population were retained and the estimation of the common support and the matching proceeded only with those observations belonging to the respective sub-population.

Table A.5.14: Subgroup analysis with respect to gender ($\gamma^{m,l}$, % points)

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
			Men – Outflows to employment				
None		*17.8*		*20.7*	10.2	13.2	19.0
Passive	*-17.8*						-8.3
Workplace							4.0
Education	*-20.7*						-1.2
Medical	-10.2						0.5
Social	-13.2						-11.1
			Men – Re-integration into labour force				
None		*22.2*	14.4		*16.5*		22.1
Passive	*-22.2*						-13.3
Workplace	-14.4						-2.0
Education							8.5
Medical	*-16.5*						-2.2
Social							-6.9
			Women – Outflows to employment				
None				*13.2*			10.6
Passive							-13.2
Workplace							4.2
Education	*-13.2*						-10.8
Medical							-0.9
Social							-6.1
			Women – Re-integration into labour force				
None				*15.7*	*16.2*		15.1
Passive							-8.1
Workplace							-1.7
Education	*-15.7*						-16.1
Medical	*-16.2*						-5.5
Social							0.3

Note: The cells contain only entries if the effect is significant at the 10% level. Effects significant at the 5% level are given in italics, those significant at the 1% level are given in **bold** letters. The estimates for men are based on 2857 observations of which 1874 belonged to the common support. The estimates for women are based on 3430 observations of which 2011 belonged to the common support.

The results for the sub-populations men and women are largely similar to the results for the whole population. Interestingly, NO rehabilitation is even more favourable for men, while the composite effects for women indicate a less strong dominance of NO rehabilitation with respect to re-employment chances. For women EDUCATIONAL rehabilitation appears rather harmful.

With respect to age the results for the younger sub-population of 18 to 45 years old are rather unspectacular and in line with the previous population treatment effects. On the other hand the

Table A.5.15: Subgroup analysis with respect to age ($\gamma^{m,l}$, % points)

l / *m*	None	Passive	Workplace	Education	Medical	Social	Composite Effect
				Age 18-45 years – Outflows to employment			
None				14.1			9.3
Passive						-17.5	-7.4
Workplace							3.5
Education	-14.1					-19.7	-3.5
Medical							-1.4
Social		17.5		19.7			-0.4
				Age 18-45 years – Re-integration into labour force			
None			12.2		*14.6*		12.3
Passive							-7.3
Workplace	-12.2						-5.2
Education							-3.2
Medical	*-14.6*						-8.7
Social							5.4
				Age 46-55 years – Outflows to employment			
None		**28.1**		**24.0**		*15.3*	16.5
Passive	**-28.1**		*-28.9*		-17.6		-8.9
Workplace		*28.9*		*24.7*		16.1	10.2
Education	**-24.0**		*-24.7*				-23.0
Medical		17.6					1.4
Social	*-15.3*		-16.1				-11.6
				Age 46-55 years – Re-integration into labour force			
None		**30.4**				15.1	19.3
Passive	**-30.4**		*-26.6*		-20.4		-17.9
Workplace		*26.6*					10.5
Education							-8.1
Medical		20.4					2.1
Social	-15.1						-7.7

Note: The cells contain only entries if the effect is significant at the 10% level. Effects significant at the 5% level are given in *italics*, those significant at the 1% level are given in **bold** letters. The estimates for age 18-45 are based on 3933 observations with 2754 observations in the common support, while the estimates for age 46-55 are based on 2354 observations with 1159 observations in the common support.

results for the 46 to 55 years old significantly indicate a strongly negative effect for EDUCATIONAL training. For this age group EDUCATIONAL rehabilitation decreases re-employment chances by about 24% compared to NO and WORKPLACE rehabilitation. The composite effects indicate an even larger harmful effect. EDUCATIONAL rehabilitation is also unsuccessful in re-integrating participants in the labour force.

Differentiating according to previous health record shows no sizeable differences for those who did *not* participate in VR in the twelve-month period before the beginning of the current sickness spell. On the other hand, for the subgroup of cases which have been sick for less than 15 days in the previous six months WORKPLACE and to some extent also EDUCATIONAL rehabilitation appear somewhat less disadvantageous in light of their composite effects. Nevertheless, the pair-wise effects remain rather unchanged. The estimation results for the complementary populations of cases with previous VR participation and with extended previous sickness spells, respectively, are not reported since all estimated effects were insignificant.

Table A.5.16: Subgroup analysis with respect to health record ($\gamma^{m,l}$, % points)

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
			No previous vocational rehabilitation – Outflows to employment				
None		*13.5*		**20.3**			11.0
Passive	*-13.5*						-12.7
Workplace				*15.1*			5.0
Education	**-20.3**		*-15.1*		-13.0	*-19.4*	-5.5
Medical				13.0			-1.0
Social				*19.4*			-4.1
			No previous vocational rehabilitation – Re-integration into labour force				
None		*15.1*	*11.9*		*13.1*		15.5
Passive	*-15.1*						-15.6
Workplace	*-11.9*						-1.3
Education							-0.1
Medical	*-13.1*						-4.1
Social							1.4
			Previous sickness record < 15 days – Outflows to employment				
None		*16.9*		17.8	11.0		16.1
Passive	*-16.9*					-17.6	-20.3
Workplace							11.1
Education	-17.8					-18.6	-0.1
Medical	-11.0						0.4
Social		17.6		18.6			-4.0
			Previous sickness record < 15 days – Re-integration into labour force				
None		*20.3*			**17.8**		20.3
Passive	*-20.3*						-24.1
Workplace							3.8
Education							7.7
Medical	**-17.8**						-5.1
Social							3.9

Note: The cells contain only entries if the effect is significant at the 10% level. Effects significant at the 5% level are given in *italics*, those significant at the 1% level are given in **bold** letters. The estimates for the group: no participation in VR in previous twelve months are based on 5611 observations with 4030 observations in the common support, while the estimates for previous sickness below 15 days (in last six months) are based on 3725 observations with 2353 observations in the common support.

Finally, the sub-populations of regularly employed and of Swedish born persons are considered. Effects for the complementary samples were not estimable due to their low number of observations. For the previously employed EDUCATIONAL and WORKPLACE rehabilitation seem to be even more harmful to re-employment chances vis-à-vis no rehabilitation than for the whole population.

Table A.5.17: Subgroup analysis for employed and Swedish born individuals ($\gamma^{m,l}$, % points)

l / m	None	Passive	Workplace	Education	Medical	Social	Composite effect
			Previously employed – Outflows to employment				
None		*17.2*	8.1	**23.5**	10.2		15.1
Passive	*-17.2*						-15.1
Workplace	-8.1			15.4			2.7
Education	**-23.5**		-15.4			-19.7	-10.7
Medical	-10.2						-1.0
Social				19.7			-1.0
			Previously employed – Re-integration into labour force				
None		13.9	*11.2*		*11.0*		13.4
Passive	-13.9						-13.5
Workplace	*-11.2*						-2.2
Education							2.5
Medical	*-11.0*						-3.5
Social							1.8
			Swedish origin – Outflows to employment				
None				**16.3**			11.2
Passive							-12.5
Workplace				11.7			4.3
Education	**-16.3**		-11.7			*-15.8*	-4.8
Medical							1.5
Social				*15.8*			-1.0
			Swedish origin – Re-integration into labour force				
None			9.4		*13.9*		15.7
Passive							-13.8
Workplace	-9.4						-0.1
Education							0.4
Medical	*-13.9*						-2.9
Social							-0.4

Note: The cells contain only entries if the effect is significant at the 10% level. Effects significant at the 5% level are given in *italics*, those significant at the 1% level are given in **bold** letters. The estimates for the previously employed are based on 5105 observations of which 3478 belonged to the common support, while the estimates for the Swedish born are based on 5394 observations of which 3677 belonged to the common support. The numbers of unemployed and non-Swedish born were too low to estimate any effects.

Even the pair-wise effect of no and workplace rehabilitation is significant, albeit weakly, and amounts to a decrease in the re-employment likelihood of 8% due to workplace rehabilitation. For the sub-population of Swedish origin the results are very similar to those for the population.