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Before-After Differences in Labor Market Outcomes for Participants in Medical Rehabilitation in Germany

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Abstract

The authors examine the labor market reintegration after medical rehabilitation by analyzing a large representative administrative panel data set for Germany. The research design focuses on socio-demographic group differences in before-after differences in days with unemployment benefits, days in employment, and labor income of participants in medical rehabilitation. The mean before-after differences indicate that the number of days with unemployment benefits is larger and the number of working days and labor income are smaller after the rehabilitation than before. Our regression analysis further reveals that the before-after differences in labor market outcomes differ significantly between socio-demographic groups.

JEL Classification: I1, J2

1. Introduction

Participation in medical rehabilitation is a central topic in health economics and health policy, as the use of health care services is connected to huge monetary and non-monetary costs. In 2012 curative and rehabilitative services incurred more than half of total current healthcare expenditure in most European countries. In Germany the share of 54.47% added up to 158,200 million Euros (Eurostat, 2015). Large amounts of money invested in rehabilitative treatments give rise to a discussion, whether rehabilitation therapies are effective and all of them are necessary. Indeed, participation in rehabilitation treatments goes along to a great extent with moral hazard. In 1997, among others, a higher daily co-payment was introduced in the German market for rehabilitation care in order to reduce public healthcare expenditure. Empirical evidence suggests that this cost containment measure was an effective one and led to a reduction in the use of health care services (Ziebarth, 2014). In fact, a 1% increase in the daily co-payment is estimated to cause a 0.3% decrease in the demand for medical rehabilitation programs (Ziebarth, 2010). The costs originated from the use

of rehabilitation treatments, however, can be partially or fully justified in case of efficient and effective rehabilitation treatments. In the field of medical rehabilitation, health economists have addressed the issue of both efficiency of providing rehabilitation and effectiveness of rehabilitation programs in order to optimize its provision (Johnston et al., 2003; Haaf, 2005).

The analysis of the medical rehabilitation effectiveness covers aspects associated with the patients' reintegration into the labor market, their health-related quality of life and the health results with respect to the diagnosis made before the treatment (Fuhrer, 2000). Analyses of effectiveness of the German rehabilitation treatments of diseases of the circulatory and nervous systems as well as the musculoskeletal system find controversial evidence. The studies reviewed by Haaf (2005) report weakly positive health-related effects in a three to twelve months follow-up period and a negligible impact within a longer time period. Hüppe / Raspe (2005) systematically reconsidered all available German studies on the effectiveness of inpatient rehabilitation for chronic back pain. Scarce medium-term improvements of the patients' state of health suggest the need for a review of the German inpatient rehabilitation for chronic back pain. However, due to lack of randomization in research designs the definition of a causal relationship between the treatment at issue and the outcomes of interest is questionable. With respect to the patients' employment outlooks the most commonly analyzed labor market outcome is return to work (Mackenzie et al., 1998). Other job-related variables refer to the number of days on sick leave and functional ability, whereas pain intensity and patient satisfaction measures are common in the research on health-related quality of life evaluations of rehabilitation treatments.

Our paper contributes from the labor market perspective to the scarce literature on the effectiveness of medical rehabilitation in Germany, which we analyze in relative terms comparing the outcomes between different socio-demographic groups (Raspe, 2009). It explicitly tackles the question left open in the German studies on labor market related outcomes, which consider only the diagnosed employability capacity of the patients after a completed treatment and often focus on specific diagnoses. In the light of the above, our analysis makes a step further and takes into account the before-after differences in terms of specific labor market related outcomes such as the number of days with unemployment benefits, days in employment, and labor income, whereby different socio-demographic groups are compared to each other. For this purpose we use the large-scale administrative data on completed medical rehabilitation in the time period 2002 – 2009 made available by the Research Data Centre of German Pension Insurance. Unfortunately, our data lacks a control group, because all individuals in the sample have participated in rehabilitation during the observation period so that all of them belong to the treatment group. This is a frequent limitation in studies on the effectiveness of medical rehabilitation treatments using administrative data for participants in rehabilitation. Conse-

quently, we cannot analyze causal average treatment effects. But we can analyze which groups perform better than other groups that have undergone rehabilitation, i.e., for whom the before-after differences in labor market outcomes are larger or smaller as an indicator for differences in the effectiveness of rehabilitation.

The remainder of the paper is organized as follows. Section 2 describes the institutional background of medical rehabilitation in Germany and summarizes the most relevant literature pertinent to the scope of this paper. Section 3 presents the data set along with our econometric approach and summary statistics for our variables of interest. Section 4 presents our estimation results. Section 5 concludes with a short summary and discussion of our main findings.

2. Institutional Background and Literature Review

Participation in medical rehabilitation in Germany presupposes application for a rehabilitation treatment based on the corresponding medical diagnosis. The latter includes the recommended type, duration, begin and implementation form of the treatment, which can occur on inpatient or outpatient basis. Moreover, rehabilitation need, target, and potential have to be stated. The responsible reimbursement authority subsequently approves the application for a rehabilitation treatment. Independently from the fact to which reimbursement authority the application at issue has been submitted, the reimbursement authorities decide within whose jurisdiction the application in question falls. The reimbursement authority, be it the statutory pension insurance or a health insurer, is concerned in the first place, as it covers the related expenses and is directly interested in the outcomes of the treatment. In 2012 the German Statutory Pension Insurance approved 1,097,538 applications for medical rehabilitation, which is 0.9% more in comparison to the previous year and 3.2% more with respect to 2010 (German Statutory Pension Insurance, 2014a). In the applications for medical rehabilitation in Germany, the most recurrent health disorder is the low back pain, which in 2013 accounted for 31.5% of all medical and other rehabilitative services provided by the German Statutory Pension Fund (German Statutory Pension Insurance, 2013). In fact, it is the largest finance provider of medical rehabilitation treatments for the employed individuals in Germany, followed by the statutory health insurance. In case of private health insurance, funding of health care services is negotiated in individual contracts. If participation in medical rehabilitation is directed to enhance the ability to work of employed people at working age, job-seekers or reduced earning capacity pension recipients, the German Statutory Pension Insurance is responsible for meeting the costs. This authority aims essentially at preventing costs connected with early retirement following the principle of rehabilitation before pension. The health insurance is generally responsible when appliers are non-working

adults and pensioners implementing the concept of rehabilitation before (long-term) care. The target is thereby to avert disability and care dependency.

The approval comes along with the assignment to a rehabilitation center according to the treatment type. During the treatment a patient's co-payment in the amount of 10 Euros per day is usually required. The contribution period depends on the type and duration of the treatment, the reimbursement authority and the amount already paid in the same calendar year. However, depending on a patient's income both authorities can grant full or partial exemptions. In general, in case of outpatient treatment no co-payments are due. After a completed treatment in rehabilitation center a discharge diagnosis is reported. If immediate return to work to the previous extend is temporarily hampered and consequently aftercare and follow-up treatments are needed, gradual reintegration into the working life is possible. In this case a patient is entitled to interim payment. Ultimately, use of health care services is inevitably accompanied with foregone income due to absence from work.

An inpatient treatment lasts ordinarily three weeks, but can be prolonged if necessary (Augurzky et al., 2009). Within the first 6 weeks of an employee's absence from work the employer is obliged to continued wage payment. Thereafter, interim payment is granted to the patient. Indeed, an employee's participation in medical rehabilitation burdens the employer with costs as well. Constrained by his employee's rehabilitation leave the employer is induced to bear additional costs due to replacement of the absent workforce. A characterizing feature of medical rehabilitation consists in treating health deficiencies, which may not be immediately perceived by non-experts. The employer, for instance, may reluctantly concede time off the job due to nutritional and metabolic disorders or diseases of the respiratory or musculoskeletal systems. In line with this property, employees hesitate to demand for medical rehabilitation in order not to send out a signal of indisposition to the employer. Recent studies analyzed the effect of job insecurity on the individual's demand for medical rehabilitation of private sector employees. Based on the German Socio-Economic Panel (SOEP) Reichert et al. (2015) used in their paper information on rehabilitation participation and subjectively measured job insecurity as well as standard individual socio-economic characteristics. The resulting statistically significant negative effect of job insecurity on participation in medical rehabilitation can be interpreted as foregone use of health care services due to the employee's fear of job loss. However, due to limitations of their data the kind of foregone treatments is not observable and an important issue of the effectiveness of medical rehabilitation services is not handled. If the foregone treatment is effective in terms of reintegration into the labor market, it might smooth the adverse attitude of the employer towards the inconvenience caused by the employee's rehabilitation leave.

The main objective of rehabilitation measures directed to the working age patients is to retain their working capacity, to facilitate their reintegration into

the labor market, and to avoid early retirement (German Statutory Pension Insurance, 2014b). Return to work is, therefore, the primary target outcome of medical rehabilitation and at the same time an indicator of its effectiveness. However, studies published up to date frequently lack randomization or even control groups, so that the associated results can only be interpreted as indicative of rehabilitation effectiveness without implication of causality. Nevertheless, even descriptive or cross-sectional studies give some orientation. Several approaches to measure return to work after disabling injury or illness have been proposed in the literature. Krause et al. (2001b) reveal in their literature review of determinants of disability duration and return to work a variety of direct and indirect measures of return to work outcomes. The latter include an individual's actual return to work, the ability to return to work, the duration of receipt of workers' compensation wage replacement benefits, earnings data, unemployment or retirement. Return to work outcomes usually refer to a point of time after a disabling disease or other health deficiency and imply a comparison with the situation before. The considered period of time in the short run ranges from the termination of rehabilitation to two years thereafter (Gallagher et al., 1989; Mau, 2006; Bloch/Prins, 2001; Krischak et al., 2013; Reichert/Kristek, 2011). Studies on return to work generally use survey data. However, routine data from social security institutions form an additional important data source in the analysis of medical rehabilitation effectiveness. A pension insurance follow-up database covers comprehensive information of all insured persons who participated in a rehabilitation treatment and allows descriptive analyses of changes of employment status in the years following the rehabilitation.

Findings on return to work show that a proportion of more than 80% of the rehabilitation patients can be reintegrated into the labor market two years after completing the granted rehabilitation measure (Buschmann-Steinhage/Zollmann, 2011; Krischak et al., 2013; Mau, 2006). Across studies successful work resumption is generally referred to as effectiveness of medical rehabilitation, giving an impression about the dynamics of the employment status after a rehabilitation treatment rather than providing final conclusions with respect to the causal effect of rehabilitation. In fact, Raspe (2009) encourages better evidence for effectiveness of the German rehabilitation system. In terms of the determinants of return to work, the focus often lies on specific diagnoses such as musculoskeletal disorders (Krischak et al., 2013; Bloch/Prins, 2001; Mau, 2006; Gallagher et al., 1989), cancer (Spelten et al., 2002) or alcohol dependency (Buschmann-Steinhage/Zollmann, 2008; Walsh et al., 1991). Bloch/Prins (2001) consider in their longitudinal country comparative study patients with lower back pain. The participants came from six western countries and were out of work for a period of at least three months due to lower back pain. It seems to be that, the type of medical treatment contributes little to explain successful resumption of work. Moreover, the authors examine the effectiveness of different types of medical treatment such as back surgery, pain relieving in-

jections or muscle training with respect to the resumption of work. They find with one exception no significant relationship between medical treatments and return to work. Only in the Swedish cohort a back surgery during the first three months shows a positive effect. However, the authors note that a poorer back function may be the reason for the treatment instead of its effect. More important determinants of successful work resumption result to be the initial health status and a few baseline characteristics. Other studies in the field of musculoskeletal disorders focus on differences in the effectiveness between inpatient and outpatient rehabilitation measures (Bührlen / Jäckel, 2002; Bürger et al., 2002; Mau et al., 2002). The comparison between inpatient and outpatient rehabilitation forms reveals no significant differences between these groups in terms of their return to work rates. In fact, 70 – 77 % of the patients could be successfully reintegrated into the labor market one year after completing the rehabilitation measure irrespective of whether it was an inpatient measure or not.

In the field of alcoholism, Buschmann-Steinhage / Zollmann (2008) use the data from the German Statutory Pension Insurance and direct their attention towards the labor market outcome in the short run. The authors report in their findings that 18 % of alcohol dependent patients are gainfully employed subject to statutory social security for twelve months on average within two years after the pertinent medical rehabilitation. Walsh et al. (1991) contribute to the debate on the effectiveness of different treatment options for alcohol-abusing workers. In a design of random assignment of patients to three possible rehabilitation programs, the authors compare the groups with respect to their job performance and drinking and drug use in the course of a two-year follow-up period. The assignment occurs to the following treatment options: compulsory inpatient treatment, compulsory attendance at Alcoholics Anonymous (AA) meetings and a choice between these options. In terms of the measures of job performance such as hours missed from work, problems with supervisors, warning notices, drinking on the job, and absenteeism because of drinking, Walsh et al. (1991) do not find any significant differences among the treatment groups. However, results concerning the measures of drinking and drug use such as average daily number of drinks, number of drinking days per month, serious problems, intoxication, blackouts, definite alcoholism and cocaine use are not univocal. In fact, there are statistically significant differences in the last four measures among the three treatment groups in the follow-up period. The inpatient care group reveals to be the most effective (Walsh et al., 1991). This evidence suggests that the mandatory in-hospital treatment of alcohol-dependent workers is the most effective to recover from alcohol abuse and thus the high costs connected with the inpatient cure can be justified.

With respect to work resumption individual socio-economic aspects seem to be more predictive than the type of medical treatment. The following studies identify the variables significant in the prediction of rehabilitation effectiveness, but do not draw conclusions about the causal relationship of the consid-

ered variables and the labor market outcome. The relationship between age and return to work outcomes is well documented. The findings point to a negative effect of an older age on work resumption two years after the start of work incapacity due to low back pain (Gallagher et al., 1989; Bloch / Prins, 2001; Krause et al., 2001a; Krischak et al., 2013; McKenzie et al., 1998; Weis et al., 1992). Bloch / Prins (2001), for example, find the lowest work resumption rates in the oldest group (age 55 and over). However, there is no evidence of high rates in the youngest group (under age 24), but in the next two youngest groups (ages 25 – 44). Household composition also plays a role in this context. In fact, Bloch / Prins (2001) point out that individuals who live alone are more likely to leave the labor market. Cheadle et al. (1994) examine in their population-based retrospective study factors that predict duration of work-related disability. The results suggest that among other factors a divorced marital status has a positive effect on duration of disability. The effects of gender are in contrast not univocal. Whereas some studies reveal reduced return to work rates for females (Bloch / Prins, 2001; Cheadle et al., 1994; Kemmlert / Lundholm, 1994), the others find no gender effect (Krause et al., 2001a).

Another socio-economic factor that is discussed in the literature is the migration background. Brzoska et al. (2010) analyze the influence of the migration background on the occupational performance after completing a medical rehabilitation measure. They use routine data from the German Statutory Pension Insurance which contains information about individuals who completed a medical rehabilitation granted by the insurer. Occupational performance in terms of capacity to work in former occupation after discharge from rehabilitation facility was assessed by a physician. Foreign nationals perform worse compared to the German ones. The authors note that these differences cannot be only explained by socio-economic differences or poorer initial health, but rather by the inability of the rehabilitative system to accommodate patients with different expectations and cultural differences. Furthermore, the authors point to the following shortcomings in their analysis. First, a causal relationship cannot be established due to the nature of the data. Second, important covariates cannot be considered, which together with missing data on occupational performance prior rehabilitation makes the assessment of rehabilitation effectiveness inaccurate. Well documented in the literature is the positive influence of a higher educational level on work resumption (Bloch / Prins, 2001; McKenzie et al., 1998; Kemmlert / Lundholm, 1994). McKenzie et al. (1998) examine in their prospective cohort study of individuals treated for a lower extremity fracture risk factors on return to work. The authors note that individuals who are higher educated may have a better ability to adapt to changing circumstances and, therefore, have more job mobility. Kemmlert / Lundholm (1994) consider the employment status of individuals three years after a musculoskeletal occupational injury. Their results suggest that a higher educational level is positively associated with employment.

Other studies include occupational factors to explain the resumption of work after disability due to injury or illness. Cheadle et al. (1994) find negative influence of construction and agricultural work on the duration of disability. Krischak et al. (2013) focus on patients with coxarthrosis and analyze their reintegration into the labor market two years after rehabilitation due to implantation of a hip joint endoprothesis. For their analyses the authors use data from the German Statutory Pension Insurance. Moreover, they identify manual labor prior to rehabilitation as a risk factor for re-entry into employment. Weis et al. (1992) come to similar results in the case of cancer. Former patients with different cancer diagnoses treated in a university medical center reported their actual employment problems and the changes of job conditions due to cancer. The results of the study indicate that an occupational status characterized by manual work is negatively related to return to work. Krause et al. (1997) examine job characteristics as predictors of disability retirement. The individuals were drawn from a random sample of men who participated in an ischemic heart disease risk factor study. The observation period included a baseline and a follow-up period of on average 4.2 years. Heavy work, work in uncomfortable positions, long work hours, noise at work, physical job strain, musculoskeletal job strain, repetitive or continuous muscle strain result to increase the incidence of disability retirement. The latter is confirmed by a further finding, that a blue collar occupation is positively associated with disability retirement.

3. Data and Econometric Approach

3.1 Data Set

For our analysis we use the routine data collected by the German Statutory Pension Insurance. The longitudinal data set includes a random sample of 20% of all individuals who completed medical rehabilitation treatments granted by this insurer. A scientific use file of the data on completed rehabilitation in the course of insurance 2002 – 2009 was made available by the Research Data Centre of the German Pension Insurance (FDZ-RV, 2012). The data set consists of 3 databases.

– **SUFRSDV09BYB**. It is a pension insurance follow-up database, which provides information on insurance relationship and amount of contribution payments. Moreover, individual income in the period 1999 – 2009, i.e., before and after participation in medical rehabilitation, is reported. Information on the outcome variables of interest in this research field such as number of worked days and days with unemployment benefits are also collected in the database and employed in this study.

– **SUFRSDV09MCB**. It includes all the cases with at least one completed medical rehabilitation, which in single cases may be supported by vocational

rehabilitation and/or followed by granted pension benefits. The following variables contain detailed information on rehabilitation events during the reporting period 2002–2009: type of granted rehabilitation, implementation form on an inpatient or outpatient basis, begin/end of the treatment and its duration in days, rehabilitation region and medical discharge diagnoses. Moreover, labor market related variables at the moment of or shortly before the application for a rehabilitation treatment such as labor status, most recent activity, occupational status, months of disability in the previous 12 months, performance in hours in the last occupation or other activity and ability to work after rehabilitation with respect to the last employment are also available.

– **SUFRSDV09KOB**. Standard socio-demographic characteristics such as birth/death year, nationality, residence region, gender, marital status, and education of the sample complete the data.

One of the advantages of this data set lies in its administrative nature as opposed to a survey. Limitations of self-reported data are directly connected to the sensitivity of revealed information. As a result, certain health deficiencies such as mental illness or dependency disorders may be understated or not stated at all, which in turn reduces the survey response rate. On the contrary, administrative data register individual health status based on medical diagnoses. Moreover, this measurement of health deficiencies contributes to a higher case number. In the time period at issue, a single medical rehabilitation is completed by about 75% of rehabilitants, whom we focus our attention on.

In fact, we include only individuals who completed exactly one rehabilitation measure in the time period from 2002 to 2007 and for whom we can observe labor market outcomes two years before and two years after the rehabilitation measure. An additional sample restriction in line with the research question is implemented with respect to age. We keep only individuals between 20 and 62 in the year of participation in medical rehabilitation so that all individuals are in a working age even two years before and after the rehabilitation. Moreover, we have dropped observations with missing values.[1] The final estimation sample adds up to 442,036 individuals, of whom 245,147 are male and 196,889 are female.

[1] Due to the larger shares of missing values for education and occupational degrees, we have included "unknown, not applicable" as separate categories in the regressions, which then serve as reference groups for education and occupational degrees. From the remaining sample, we have further dropped four observations, which had the obscure diagnose "External Causes of Mortality". Note that individuals who died within the two years after rehabilitation are of course excluded from our sample and that only fully completed rehabilitations are considered.

3.2 Econometric Approach and Variables

As discussed in our literature review, many large-scale empirical studies about effectiveness of medical rehabilitation with respect to labor market outcomes use the medical diagnosis about the employment capacity (not employable, working time per day) after the rehabilitation, which suffers however from a subjectivity bias of the doctor in charge and does not necessarily reflect the real labor market outcome. Moreover, most studies – including those using the actual employment status – simply look at the outcomes after rehabilitation, which neglects unobserved time invariant heterogeneity, which might affect the outcomes before the rehabilitation as well.[2] In order to mitigate both limitations of earlier studies, we use the difference before and after the rehabilitation for objective labor market outcomes such as days with unemployment benefits, working days, and labor income in Euros. All three outcome variables are of course highly correlated with each other, because more working days, ceteris paribus, decrease the number of days in unemployment and increase labor income. Nevertheless, we think it is important to analyze all three outcome variables separately. First, the total number of days cannot only be divided in employment and registered unemployment but also in other sources of non-employment (e.g., family responsibility, early retirement). Second, we have only information about the number of working days and no information about actual working hours and hourly wages in the data, which are included in total labor income.

The panel data, from which we generate a cross sectional data set with a medical rehabilitation in year t, allows us to generate several differences before and after rehabilitation for days with unemployment benefits, working days, and labor income as dependent variables. Our preferred specification takes the difference between the total sum over the two years after the rehabilitation and the total sum over the two years before the rehabilitation $(DIFFSUM = ((Y_{i,t+1} + Y_{i,t+2}) - (Y_{i,t-1} + Y_{i,t-2})))$. Looking at the two years before and after the rehabilitation reduces potential biases produced by outliers or anticipation effects before and integration effects after the rehabilitation. One can question, however, if a specific diagnosis for rehabilitation in year t has already an effect on unemployment, employment, and income two years earlier. This might be the case for many diagnoses, as the health deficiency is likely to occur for a longer period in order to go into rehabilitation so that labor market out-

[2] Typical examples for time invariant personal characteristics in the context of labor are personal traits such as self-control and motivation, which cannot be observed in most data might hence lead to an omitted variable bias if one considers only the outcomes after the rehabilitation. For example, lower self-control and motivation are, on the one hand, negatively correlated with labor market outcomes such as employment or income and, on the other hand, negatively correlated with explanatory variables of interest (e.g., schooling, mental health, occupational status).

comes should also be negatively affected. Nevertheless, we use three different outcome variables as robustness checks by comparing the outcomes in the first or second year after rehabilitation with the outcomes in the year directly or two years before the rehabilitation.

As gender differences in labor market and health outcomes are a common finding, we include a dummy variable for being female in the estimates for the complete estimation sample. Moreover, we are especially interested in age specific differences, as rehabilitation might be especially ineffective for older participants, for whom integration into the labor market might be more problematic because of worse employment prospects and lower incentives to accept a job – and therefore rather wait for old age retirement or even go into early retirement. Thus, we include a vector of several age categories in our specification. For a more detailed picture, we further estimate a specification with dummy variables for every year of age. In order to facilitate the interpretation, we will predict and plot non-linear age profiles instead of an interpretation of coefficients. We further include the marital status. The nationality and education of the participants are also taken into account. Moreover, we include employment and job related variables such as the regular job position and the employment status before the rehabilitation. We further account for differences in 14 occupations, which we treat as a control variable and which results are not further discussed. In order to deal with aggregated influences, we take into account year dummies and dummies for the 16 German federal states, in which a participant lives.[3] At last, we include the detailed medical discharge diagnoses. Because of the 166 different diagnoses included as dummy variables, we do not present their estimated parameters and do not discuss the results. Thus, the medical diagnoses serve only as control variables and we leave diagnose specific differences in the effectiveness of rehabilitation to medical researchers. To sum up, our general estimation framework for our preferred specification looks as described in equation (1), in which i denotes the individual, t the year in which the rehabilitation takes place, the constant, coefficients and the usual error term, and can be estimated by using linear regressions with OLS (ordinary least squares).

$$
\begin{aligned}
((Y_{i,t+1} + Y_{i,t+2}) - (Y_{i,t-1} + Y_{i,t-2})) = \alpha &+ \beta_1 FEMALE_{it} + \beta_2 AGECATEGORY_{it} \\
&+ \beta_3 MARTIALSTATUS_{it} + \beta_4 NATIONALITY_{it} \\
&+ \beta_5 EDUCATION_{it} + \beta_6 JOBPOSITION_{it} \\
&+ \beta_7 EMPLOYMENTSTATUS_{it} + \beta_8 OCCUPATION_{it} \\
&+ \beta_9 YEAR_{it} + \beta_{10} REGION_{it} + \beta_{11} DIAGNOSE_{it} + \varepsilon_{it}
\end{aligned} \tag{1}
$$

[3] Aggregated influences include, for example, business cycle effects, labor market and health policy changes. As we use nominal income changes for different years, the year dummies also take into account differences in the inflation rates between years.

In Table 1, we present definitions, means, and standard deviations of our variables of main interest for the complete estimation sample. At first, we take a look at our dependent variables, i.e., the average differences in labor market outcomes before and after the rehabilitation. It can be seen that the number of days with unemployment benefits is higher and that the number of working days and total labor income are lower after the rehabilitation, which indicates that rehabilitation does on average not seem to be very effective in terms of increasing employability. Note however that we do not address health effectiveness in our paper. In more detail, the number of days with unemployment benefits increases on average by about 80 days in the two year spans (*UDIFFSUM*). The number of working days decreases on average by about 137 days in the two year spans (*WDIFFSUM*). The total labor income decreases on average by about 8277 Euros in the two year spans (*IDIFFSUM*). When looking at the before-after differences in income, it should be kept in mind that we use nominal wages and not real wages. Consequently, the income differences over time are upper bounds due to inflation and regular wage growth over time.

Table 1

Definition of Variables and Descriptive Statistics for Complete Sample

Variable	Mean	Std. Dev.
Before-after difference in number of days with unemployment benefits:		
$UDIFFSUM = \left(\left(Y_{i,t+1} + Y_{i,t+2}\right) - \left(Y_{i,t-1} + Y_{i,t-2}\right)\right)$	80.3832	234.2524
Before-after difference in number of working days:		
$WDIFFSUM = \left(\left(Y_{i,t+1} + Y_{i,t+2}\right) - \left(Y_{i,t-1} + Y_{i,t-2}\right)\right)$	–136.6612	277.6018
Before-after difference in total labor income in Euros:		
$IDIFFSUM = \left(\left(Y_{i,t+1} + Y_{i,t+2}\right) - \left(Y_{i,t-1} + Y_{i,t-2}\right)\right)$	–8276.8420	22296.9100
FEMALE (dummy)	0.4454	
Age in years (in the year of the rehabilitation)	46.7254	9.1634
AGECATEGORY (dummies)		
20–29 years (reference group)	0.0507	
30–34 years	0.0588	
35–39 years	0.1088	
40–44 years	0.1596	
45–49 years	0.1817	
50–54 years	0.2050	
55–59 years	0.1913	
60–62 years	0.0441	
MARITALSTATUS (dummies)		
Single (reference group)	0.2504	
Married	0.6051	
Divorced	0.1215	

Widowed	0.0230
NATIONALITY (dummies)	
Germany (reference group)	0.9304
Italy, Spain, Greece, Portugal	0.0141
Former Yugoslavia	0.0151
Turkey	0.0188
Other EU and non-EU country	0.0189
Stateless, unknown	0.0028
EDUCATION (dummies)	
Unknown, not applicable (reference group)	0.2471
Low / medium secondary schooling degree without apprenticeship	0.1258
Low / medium secondary schooling degree with apprenticeship	0.5455
High secondary schooling degree without apprenticeship	0.0038
High secondary schooling degree with apprenticeship	0.0238
University of Applied Science degree	0.0290
University degree	0.0250
JOBPOSITION (dummies)	
Unknown, not applicable (reference group)	0.0995
Apprentice	0.0055
Unskilled blue-collar worker	0.1114
Low skilled blue-collar worker	0.0916
Skilled blue-collar worker	0.2612
Master craftsman, foreman	0.0112
White-collar worker	0.4070
Civil servant	0.0004
Self-employed	0.0123
EMPLOYMENTSTATUS (dummies)	
Non employment (without unemployment) (reference group)	0.1150
Full-time employment without rotating shifts	0.4847
Full-time employment with rotating shifts	0.1099
Full-time employment with night shifts	0.0483
Part-time employment with less than half of regular working time	0.0217
Part-time employment with at least half of regular working time	0.1106
Registered unemployment	0.1097

Notes: Number of observations is 442036.

Let us now turn to our explanatory variables of interest. 44.5% of the 442,036 observations in our estimation sample are female. The average age is 46.7 years, which refers to age in the year of the rehabilitation and is restricted to 20 to 62 in our estimation sample. The age categories indicate that about 5%

are younger than 30 years of age, 6% are aged between 30 and 34 years, and nearly 5% are at least 60 years old. All other age groups have shares between 10% and 20%. In our more detailed specification for the prediction of age profiles, we have 43 categories for every year of age. Even though we do not present the shares for all of these groups, it should be noted that the number of observations for the oldest age groups is still large enough (n = 3653 for 62 year old; n = 6694 for 61 year old; n = 9142 for 60 year old; n > 10000 for each year younger than 60 years) to obtain consistent and efficient estimates due to our large sample size.

About 25% of the observations are singles, 61% are married, 12% are divorced, and 2.3% are widowed when they participate in the rehabilitation. Moreover, 93% have the German nationality (citizenship) and the largest group of non-Germans in the data is people with a Turkish citizenship (1.9%). We can further see that most of the rehabilitation participants in our sample are not highly qualified. Overall less than 10% have obtained the highest secondary schooling degree (< 3% have a university degree, < 3% have a degree from a university of applied science, < 3% have high secondary schooling without any university degree), whereas more than 12% have a low or medium secondary schooling degree without an additional apprenticeship degree and nearly 55% have a low or medium secondary schooling degree with an apprenticeship degree. The job position further informs us that about 20% are unskilled or low skilled blue-collar workers, 26% are skilled blue-collar workers, an additional 1.12% is in master craftsman or foreman positions, 41% are white-collar workers, a negligible 0.04% is civil servants, and 1.23% are self-employed.[4] The employment status informs about the status before the rehabilitation was undertaken. Nearly 12% have been non-employment (without unemployment) and about 11% have been in registered unemployment, whereas about 64% have been in full-time employment and about 13% in part-time employment.

4. Estimation Results

In Table 2, we present the regression results for the before-after rehabilitation differences for days with unemployment benefits, working days, and total labor income. In our preferred specification, we use the differences in total sums over two years before and after rehabilitation $(DIFFSUM = ((Y_{i,t+1} + Y_{i,t+2}) - (Y_{i,t-1} + Y_{i,t-2})))$. In the complete sample, the mean number of days with unemployment benefits increases on average by about 80 days in the two year

[4] Due to the low number of civil servants (n = 182) in the data, we do not discuss the regression results for them. As the number of self-employed individuals is 5443, which is quite large compared to survey data sets, we think it is worth discussing the results. Note, however, that self-employed in our data are not necessarily representative for all self-employed in Germany due to selectivity of our data.

spans (*UDIFFSUM*). The estimation results in column (1) indicate that women have in comparison to men on average a statistically significant lower number of days with unemployment benefits after the rehabilitation than before the rehabilitation, which is however not very large in size. More precisely, women have in comparison to men about 5.1 fewer days with unemployment benefits in the two years after the rehabilitation than in the two years before the rehabilitation. The next set of variables includes the age categories that give a first impression about age specific differences. A more detailed picture with predicted age profiles will be given below. The first results indicate already that the before-after difference in days with unemployment benefits is significantly lower for the middle age group 30 – 44 compared to younger workers below 30 years, which might be driven partly by young apprentices. For older individuals the number of days with unemployment benefits is significantly larger after rehabilitation. Especially noteworthy is the sharp increase for the oldest group, which indicates that rehabilitation measures for old individuals are often not an effective instrument to integrate them back in the labor market.

Table 2

Regression Results for Before-After Differences in Days with Unemployment Benefits, in Working Days, and Total Labor Income in Euros

	(1) *UDIFFSUM*	(2) *WDIFFSUM*	(3) *IDIFFSUM*
FEMALE	–5.1218***	0.9842	2112.8286***
	[0.9160]	[1.0431]	[82.3205]
AGECATEGORY			
20 – 29 years (reference group)			
30 – 34 years	–15.7622***	3.2679	–1918.6528***
	[2.1333]	[2.6589]	[191.8492]
35 – 39 years	–17.5945***	7.4922**	–1916.5949***
	[1.9459]	[2.4094]	[173.3555]
40 – 44 years	–14.5508***	7.6756**	–2057.2817***
	[1.9036]	[2.3334]	[166.6479]
45 – 49 years	–3.2434	–2.9047	–3126.0624***
	[1.9196]	[2.3395]	[167.5316]
50 – 54 years	6.7752***	–27.6314***	–5562.1479***
	[1.9414]	[2.3570]	[169.5159]
55 – 59 years	55.7195***	–98.3937***	–11388.0652***
	[2.0324]	[2.4254]	[176.2690]
60 – 62 years	118.0284***	–153.1282***	–16272.7709***
	[2.6673]	[3.0565]	[247.5988]
MARITALSTATUS			
Single (ref.)			
Married	–15.4786***	14.7525***	624.7368***
	[0.9827]	[1.1397]	[90.4649]

Table continued next page

Table 2 continued

	(1) *UDIFFSUM*	(2) *WDIFFSUM*	(3) *IDIFFSUM*
Divorced	–1.5814	13.4544***	667.8091***
	[1.3634]	[1.5299]	[120.3818]
Widowed	–13.7898***	13.3473***	1133.4628***
	[2.5930]	[2.9610]	[212.5683]
NATIONALITY			
German (ref.)			
Italy, Spain, Greece, Portugal	24.5073***	–20.8166***	–1689.4811***
	[3.2785]	[3.7154]	[298.0803]
Former Yugoslavia	34.8490***	–36.8018***	–2836.4021***
	[3.3127]	[3.7343]	[291.8211]
Turkey	50.5993***	–38.9526***	–2505.2138***
	[3.1206]	[3.3592]	[254.7994]
Other EU and non-EU country	28.4339***	–13.7778***	–431.2691
	[2.7840]	[3.1237]	[243.8709]
Stateless, unknown	–10.7041	18.8236**	1463.6514**
	[6.1934]	[7.0879]	[543.3961]
EDUCATION			
Unknown, not applicable (ref.)			
Low/medium schooling without apprenticeship	–19.7343***	30.2036***	2381.4326***
	[1.3904]	[1.5388]	[109.3892]
Low/medium schooling with apprenticeship	–36.7855***	49.2318***	3583.8488***
	[1.0028]	[1.1344]	[86.2835]
High schooling without apprenticeship	–39.9807***	53.4768***	5433.7031***
	[4.6867]	[6.1835]	[540.3478]
High schooling with apprenticeship	–46.0063***	63.7151***	5421.4538***
	[1.9059]	[2.5371]	[243.4025]
University of Applied Science	–71.9032***	95.5967***	7835.8759***
	[1.9458]	[2.4098]	[227.6156]
University	–50.3940***	73.0604***	6541.5428***
	[1.9023]	[2.4309]	[264.3649]
JOBPOSITION			
Unknown, not applicable (ref.)			
Apprentice	–10.9621	90.9029***	10080.0363***
	[6.2255]	[6.9744]	[402.5933]
Unskilled blue-collar worker	16.3642***	2.2736	2037.8100***
	[2.6505]	[2.8391]	[207.4766]
Low skilled blue-collar worker	10.2166***	0.2311	1200.1677***
	[2.6842]	[2.9199]	[217.4641]
Skilled blue-collar worker	–0.1688	1.4168	618.4064**
	[2.5111]	[2.7171]	[206.0825]
Master craftsman, foreman	–8.7776*	12.7848**	–259.9581
	[3.7489]	[4.5050]	[419.0827]
White-collar worker	–12.9059***	23.0082***	1139.1951***
	[2.4738]	[2.7070]	[206.5788]

Civil servant	–39.6684** [12.4266]	47.2291** [15.7350]	3721.6316* [1491.4551]
Self-employed	–120.0121*** [3.3452]	209.2382*** [3.7198]	14751.1305*** [290.7600]
EMPLOYMENTSTATUS			
Non employment (without unemployment) (ref.)			
Full-time employment without rotating shifts	23.5127*** [2.1103]	–36.8812*** [2.3662]	–2640.9743*** [184.9999]
Full-time employment with rotating shifts	22.8576*** [2.2803]	–41.8242*** [2.6232]	–3263.9040*** [206.3144]
Full-time employment with night shifts	21.5734*** [2.4961]	–36.7101*** [2.9312]	–2902.8228*** [236.6411]
Part-time employment < 0.5 regular working time	5.0193 [3.0059]	–3.3654 [3.8012]	2881.5525*** [220.9747]
Part-time employment 0.5 regular working time	33.1206*** [2.2791]	–49.9342*** [2.6509]	–550.2451** [194.1795]
Registered unemployment	–69.2146*** [2.5572]	37.2025*** [2.6592]	1580.8263*** [198.0968]
Constant	192.7312*** [9.9348]	–215.2540*** [12.2742]	–11743.3184*** [964.6791]
Occupations (14)	Yes	Yes	Yes
Years (6)	Yes	Yes	Yes
German federal states (16)	Yes	Yes	Yes
Medical discharge diagnoses (166)	Yes	Yes	Yes
R^2	0.0790	0.0908	0.0955
Number of observations	442036	442036	442036

Notes: OLS regressions with robust standard errors in brackets. Dependent variable is the before-after difference (between the sum of the two years before and the sum of the two years after the rehabilitation) in number of days with unemployment benefits (*UDIFFSUM*), working days (*WDIFFSUM*), and total labor income in Euros (*IDIFFSUM*). All included variables are dummies. Coefficients are statistically significant at * $p < 0.05$, ** $p < 0.01$, and *** $p < 0.001$, respectively.

The marital status variables indicate that the before-after difference in days with unemployment benefits is significantly lower for married and widowed individuals than for singles and divorced individuals, whereas divorced individuals do not significantly differ from singles. Without going into detail, our findings further indicate that non-Germans have significantly more days with unemployment benefits after rehabilitation than before. This finding might point to ineffective treatments due to cultural differences and reintegration problems for possibly discriminated groups in the labor market. We further find that the before-after differences in days with unemployment benefits are lower for better educated individuals. Moreover, unskilled and low skilled blue-collar workers have significantly more days with unemployment benefits than skilled blue-collar and white-collar workers after rehabilitation. Self-employed individuals have significantly fewer days with unemployment benefits, which

might indicate that their motivation – let it be incentive driven or a personal trait – to work after rehabilitation is larger.

The results for the employment status before the rehabilitation reveal some important findings. Compared to rehabilitation participants who have been not employed (but not unemployed) before the rehabilitation, we can see that the before-after difference in days with unemployment benefits is significantly larger for individuals who have been employed before the rehabilitation, whereas the before-after difference in days with unemployment benefits is significantly lower for individuals who have been already unemployed before the rehabilitation. Differences between different types of full-time employment are not significant. The estimated coefficients are however larger for part-time employed individuals with at least half of the regular working time and not significantly different from zero for part-time employed individuals with less than half of the regular working time. Overall, rehabilitation seems on average to have a more beneficial effect for individuals, who have been unemployed before the rehabilitation, than for individuals, who have been employed before the rehabilitation. Part of this effect might be attributed to our research design, in which we take the before-after difference as dependent variable, because it is easier to reduce the number of days with unemployment benefits for individuals with many than with already few days with unemployment benefits before the rehabilitation. But nevertheless, the differences between employed and unemployed indicate that many participants without a job before the rehabilitation find a job after their rehabilitation.

In column (2) of Table 2, we present the regression results for the before-after differences in working days, which correspond with the results for days with unemployment benefits. The mean before-after differences are about minus 137 working days in the two year spans (*WDIFFSUM*). Women and men do not differ significantly in the before-after difference in working days. The before-after difference in working days is significantly lower for older workers – and again sharply increasing for the oldest age groups. A more detailed picture with predicted age profiles will be given below. Moreover, we find that the before-after difference in working days is smaller for singles than for other marital groups. The results further indicate that non-Germans have significantly fewer working days after rehabilitation than before rehabilitation, which might be reasoned by ineffective rehabilitation or discrimination in the labor market. Not surprisingly, better educated individuals have a better performance, as their employment prospects in the labor market are likely to be better than for less educated groups. Individuals in an apprenticeship position before rehabilitation have significantly more working days after rehabilitation. This finding indicates that rehabilitation is very effective for apprentices as they seem easily to come back into their position. Moreover, white-collar workers have larger before-after difference in working days than blue-collar workers. The best performing group after rehabilitation are again the self-employed.

Compared to rehabilitation participants, who have been not employed (but not unemployed) before the rehabilitation, the before-after difference in working days is significantly larger for individuals, who have been unemployed before the rehabilitation, and significantly lower for individuals, who have been employed before the rehabilitation.

Our third outcome variable is the before-after difference in total labor income in Euros, which gives an additional insight as it includes potential effects on working days, working hours, and hourly wages due to its aggregate nature. Total labor income decreases on average by about 8,277 Euros in the two year spans (*IDIFFSUM*). The regression results are presented in column (3) of Table 2. The before-after income difference is on average about 2,113 Euros larger for women than for men. This finding might indicate that rehabilitation for employed women is more effective than for employed men, because either they perform better in terms of working hours or hourly wages after rehabilitation. Age is negatively correlated with the income difference before and after the rehabilitation, which is again especially large for the oldest age groups. The before-after difference is larger for married and divorced individuals than for singles; and largest for widowed individuals. Non-Germans have a worse income difference than Germans. Better educated individuals perform better. Apprentices have of course a very positive income development, because most of them are likely to enter regular employment after completion of their apprenticeship degree. Interestingly, more skilled blue-collar workers have larger income losses than less skilled blue-workers, which might be a result of reduced working hours. Self-employed have the largest income development. Compared to rehabilitation participants who have been not employed (but not unemployed) before the rehabilitation, the before-after income difference is significantly larger for individuals who have been unemployed before the rehabilitation, whereas the before-after income difference is significantly lower for individuals who have been employed before the rehabilitation, especially for those who have been full-time employed.

One of our main findings from the previous regressions is that older individuals seem to perform worse with respect to labor market outcomes after rehabilitation. For a more detailed picture, we have re-estimated our preferred specifications (*DIFFSUM*) and have replaced the eight age categories with 43 dummies for every year of age. Such a specification is completely non-linear and allows any functional form for age profiles that we plot together with the 95% confidence intervals from the predictions based on these regressions. The first age profile in Figure 1 is for the before-after difference in days with unemployment benefits. It can be nicely seen that the predicted before-after difference in days with unemployment benefits is positive for all ages, i.e., the total number of days with unemployment benefits in the two years after the rehabilitation is on average larger than the total number of days with unemployment benefits before the rehabilitation. The youngest individuals start on average with a be-

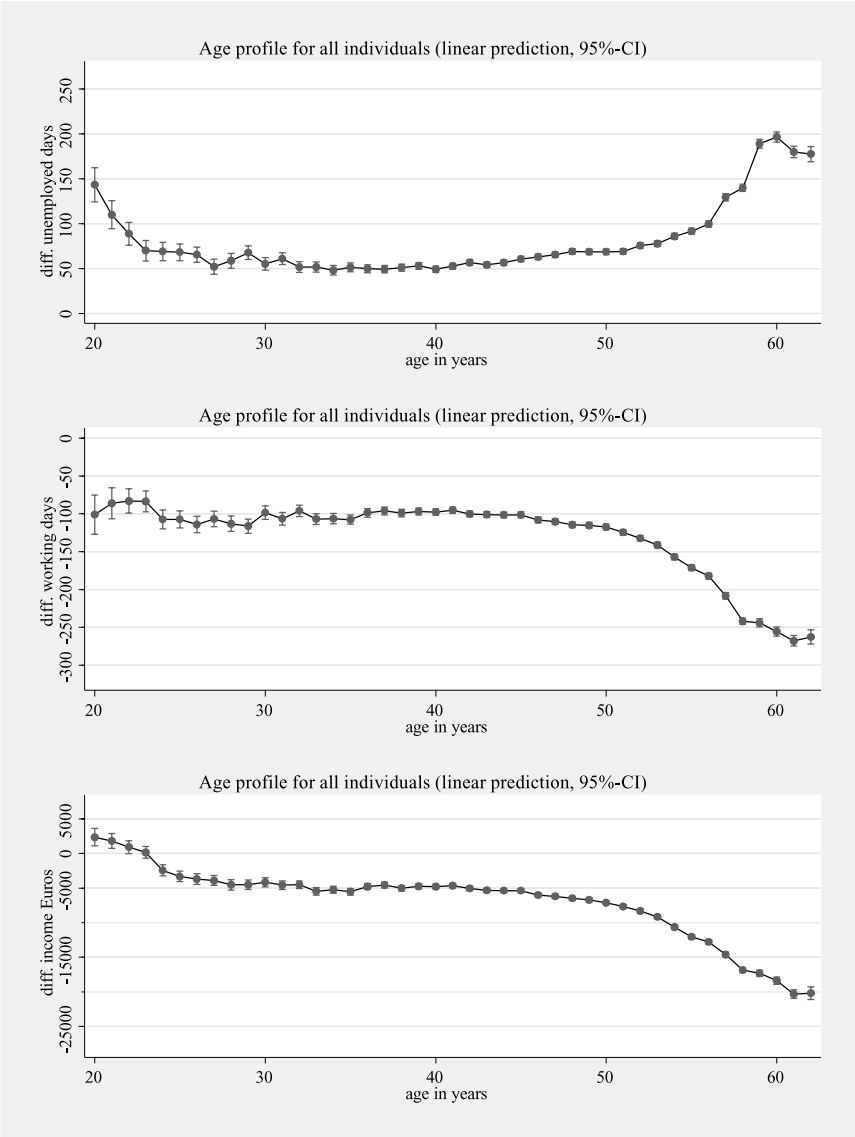

Figure 1: Predicted Age Profiles for the Before-After Differences in Days With Unemployment Benefits, Working Days, and Total Labor Income

fore-after difference of approximately 150 days with unemployment benefits, which is reduced to 50 days in the first years and remains quite stable until the age of 50. After age 50 the before-after difference in the number of days with

unemployment benefits increases to nearly 200 days for 60-year-olds. For the before-after difference in working days, we can also observe that the number remains quite stable at around minus 100 days until the age of 50, after which the number decreases to about minus 250 days for 60-year-olds. The predicted age profile for the before-after income difference reveals that the before-after income difference for the youngest individuals is even slightly positive. But after the age of 25 it remains quite stable at minus 5,000 Euros until the age of 50, after which it decreases to almost minus 22,500 Euros for 60-year-olds.

We have performed several robustness checks concerning the definition of our outcome variables with respect to the years before and after the rehabilitation $\left(\left(Y_{i,t+1} - Y_{i,t-1}\right), \left(Y_{i,t+2} - Y_{i,t-1}\right), \left(Y_{i,t+2} - Y_{i,t-2}\right)\right)$. Our results have proved to be robust. In order to check if gender specific differences in the determinants exist, we have also performed separate regressions for our preferred specification for men and women. The only slight differences have occurred for marital status and the age differences are larger for men than for women.

5. Discussion and Concluding Remarks

In this paper, we analyze the labor market reintegration of participants in medical rehabilitation, i.e., the before-after difference in the number of days with unemployment benefits, working days, and labor income. Although we think that it is important to analyze in how far medical rehabilitation affects labor market outcomes and in how far socio-demographic groups differ from each other, it should be kept in mind that we do not address the issue of rehabilitation effectiveness from the health state and quality of life perspective in our paper. Medical rehabilitation might, thus, be ineffective from a labor market perspective, but still effective in improving the lives of rehabilitation participants with serious health deficiencies. Moreover, our results for socio-demographic groups are not suitable to be used in the allocation of medical rehabilitation treatments. They might rather point to ineffective rehabilitation screening mechanisms for specific groups which might have to be reconsidered, to potential problems during the treatment (e.g., cultural differences) which could be solved, or to general integration problems which might stem from discrimination in the labor market and incentives given by the unemployment benefit and retirement system. Concrete answers to these potential problems need, however, more detailed econometric and case studies.

One of our main findings is that gender differences in levels and determinants are rather small. If anything, women perform better than men after rehabilitation, which might suggest that rehabilitation for employed women is more effective than for employed men. Older participants have worse labor market outcomes after the rehabilitation than younger participants. This conclusion is supported in the study of Bloch / Prins (2001), where the lowest work resump-

tion rates are registered in the oldest group aged 55 and over. In particular, our findings point to a sharp increase in days with unemployment benefits, which can be observed after age 56. These results induce an examination of the labor market related behavior of the older patients. It might be the case that the latter prefer not to get employed in the years directly before retirement, but rather spend this period of time in unemployment or try to get into early retirement. In line with this consideration, participation in medical rehabilitation of people near retirement age induces a chain of costs, which are connected not only with the use of health care services, but are followed by the receipt of unemployment benefits when entitled to, and subsequently pension grants. Moreover, older patients seem to be an unfortunate target group from the perspective of their reintegration into the labor market after a rehabilitation treatment. The costs related to their participation in rehabilitation seem to be unreasonably incurred. The approval of the applications for rehabilitation of this age category is questionable and should at least stimulate a discussion. A better performance of younger individuals could imply that postponements of participation in medical rehabilitation treatments are undesirable from the labor market perspective. Nevertheless, in order to avoid unethical discrimination, policy would need a good screening mechanism in order to concede rehabilitation programs also for older people who are willing to return to work, and for people who need them from a medical perspective.

Our findings further indicate that more attention should be paid to the labor market performance of non-Germans, as they have significantly worse outcomes after rehabilitation than before compared to Germans even after having controlled for the available socio-economic and demographic variables. These results are in line with the studies focused on the effectiveness of the use of rehabilitative care services of the patients with a migration background. Rehabilitation effectiveness of non-German vs. German nationals is evaluated in Brzoska et al. (2012) in terms of employability at the time of the rehabilitation conclusion. The empirical evidence supports the hypothesis that systematic factors may play an important role and cultural differences should be taken into consideration. Rehabilitation entry and implementation barriers of the people with a migration background in the form of paucity of information as well as communication and interaction difficulties can negatively influence their treatment outcomes. Moreover, better educated patients perform better. Bloch / Prins (2001) find a positive correlation between higher educational levels and work resumption. A positive association with employment of better educated participants in medical rehabilitation is also registered in Kemmlert / Lundholm (1994). Our findings confirm the results from these studies. In particular, we conclude that better educated individuals have fewer days with unemployment benefits after a completed treatment, more days in employment respectively, and have a higher labor income. These outcomes suggest that medical rehabilitation results to be particularly effective for patients with a higher education

and consequently good employment outlooks. Their opportunity costs of leisure after rehabilitation seem to be higher compared to worse educated patients. This reason might also be one of the mechanisms behind the significantly smaller number of days with unemployment benefits and the significant difference in income for self-employed participants in rehabilitation.

Due to the data structure and the available information in our data, we could only address the goal of labor market reintegration and not the health and quality of life aspects of medical rehabilitation, which are also important goals. Another limitation of our study is the causality of the treatment effects, which we could not address explicitly because of the non-randomized design and the lack of a control group in the data. Thus, we have focused on the before-after differences in labor market outcomes between socio-demographic groups. Our overall results may prompt not only the need for a reassessment of the German medical rehabilitation, but also a consideration of the rehabilitation system in a broader framework of institutions that interact with health care provision such as unemployment benefits and retirement systems. Moreover, in order to get a complete picture on the rehabilitation effectiveness it would be important to assess subjective quality of life as medical rehabilitation outcome and include in the analysis information on subjective health state of the participants, their satisfaction with the completed rehabilitation and well-being in general.

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