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ORIGINAL ARTICLE

Diverse effects of shorter potential unemployment benefit duration on labor market outcomes in Germany

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Abstract

This paper explores diverse effects of an unemployment benefit (UB) reform in Germany on labor market outcomes of individuals with health impairment. The reform induced substantial reductions in potential duration of regular UB for older workers, which is exploited in a difference-in-differences setting. The results provide evidence for a decrease in days in UB, an increase in days in employment, and an increase in days in unemployment assistance. The effects on UB and employment are smaller and the effects on unemployment assistance are larger for unemployed and non-employed individuals than for individuals who were employed before medical rehabilitations.

JEL CLASSIFICATION

I1, J2, J65

1 | INTRODUCTION

Since the Lisbon Strategy had been launched in March 2000, a bunch of reforms have been implemented in many European countries to re-establish incentives to work and to reduce withdrawals from the labor market to increase employment and to reduce structural unemployment

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(Dieckhoff & Gallie, 2007). Among other policy changes, a profound rearrangement of the unemployment insurance (UI) systems was initiated. Older workers were often the target population, because the rate of longer unemployment spells is generally higher for this age group, either due to poor employment outlooks or disincentives of reemployment (e.g., Dietz & Walwei, 2011; OECD, 2006). In Germany, a major reform of the UI system was implemented in February 2006 as part of the Hartz reforms. It involved a substantial reduction in the potential duration of regular unemployment benefits (UB; UB-1) to stimulate employment among older workers by alleviating the disincentive effect of long compensation. The reform affected older age groups, whereas younger workers under the age of 45 years were not affected by the policy change. Thus, the design of the reform provides a natural experiment setting, on which our difference-in-differences (DID) identification strategy relies to investigate the causal relationship between the potential duration of UB-1 and the labor market outcomes of the affected individuals. Our outcomes of interest are aggregated days in employment, in regular UB, and in unemployment assistance for a complete calendar year. Hence, our estimates present the combined effect from the incidence and duration of recurring spells within a well-defined time period. Moreover, distinguishing between different outcomes, including unemployment assistance, is important. For example, spikes in unemployment exit rates after exhaustion of regular UB might overestimate the incentive problem of long benefit duration, if workers exit unemployment into other states than employment (Card et al., 2007).

Instead of being interested in the total population as most other evaluation studies, our sample consists of individuals with health impairments, who underwent medical rehabilitation treatments and might be more vulnerable in terms of employment. For example, participation in a medical rehabilitation can be a negative signal for employers in terms of bad health and absence behaviour (Reichert et al., 2015). Participation in medical rehabilitation in Germany presupposes application for a rehabilitation treatment based on the corresponding medical diagnosis.[1] 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 and covers the related expenses. The approval comes along with the assignment to a rehabilitation center according to the treatment type. An inpatient treatment lasts ordinarily 3 weeks, but can be prolonged if necessary. 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. The use of routine data on labor market performance of participants in medical rehabilitation allows us to study the reform effects on this group, opening an interesting additional perspective in evaluating the reform. Official statistics on medical rehabilitation treatments indicate an increasing trend since 1997 and the German Statutory Pension Insurance alone approved more than one million applications for medical rehabilitation per year in 2015 (Buschmann-Steinhage, 2017; German Statutory Pension Insurance, 2014). Therefore, we believe that it is important to analyse the labor market performance of this group in response to policy changes. We further split the sample in employed, unemployed and non-employed individuals before the medical rehabilitation to address potential heterogeneity in the treatment effects between these groups. If unemployed and non-employed have lower labor market attachment and success, it can be expected that they react less strongly to the reduction in UB duration in terms of days in employment and unemployment. To the best of our knowledge, this is the first paper explicitly investigating a sample of individuals with health impairments and these diverse effects of the major 2006 reform of UB-1 in Germany.

Based on a DID approach, our results provide causal evidence that the substantial reduction in the potential duration of UB-1 has significantly decreased the number of days in UB-1 and has increased the number of days in employment subject to social insurance contributions. Thus, the intended reform effects of reducing unemployment and increasing employment have been largely accomplished due to a reduction of the potential duration of regular UB in Germany. However, the findings also suggest a significant increase in the number of days in unemployment assistance (UB-2) granted to unemployed jobseekers on exhaustion of UB-1 to provide them a living at the subsistence level. From a social policy perspective and neglecting potential intended fiscal effects, transitions to UB-2 instead of employment represent a rather unintended consequence of the reform, limiting the success of a policy change that aims to increase employment via reductions in the generosity of the UI system. Additionally, we look at unemployed and non-employed individuals before the medical rehabilitation, who are likely to have worse labor market prospects than individuals with a job before the medical rehabilitation. The intended reform effects of fewer days in UB-1 and more days in employment are much smaller and the unintended reform effects of transitions to UB-2 are much larger for these unemployed and non-employed samples than for individuals who were employed before medical rehabilitation.

The remainder of the paper is organized as follows. Section 2 presents a literature review. Section 3 describes the institutional setting of the German UI system. Section 4 presents the data set and samples. Section 5 describes our econometric approach and summary statistics for the variables of interest. Section 6 reports the estimation results. Section 7 concludes with a short summary and discussion of the main findings.

2 | LITERATURE REVIEW

A large body of the empirical literature explores the impact of changes in UI parameters on entry and exit from unemployment as well as on the duration of the first employment or non-employment spell, limiting the analysis of a policy change to its short-term outcome.[2] For example, Hunt (1995) investigates the impact of large increases in potential benefit duration (PBD) for older workers in former West Germany, distinguishing between escapes to employment and out of the labor force. Applying a DID method, she reports longer unemployment spells that lower the hazard rates to both exit destinations. A positive relationship between the generosity of the UI system and the duration of unemployment spells has become a stylized fact. Lalive et al. (2006) show that the replacement ratio as well as PBD are both important policy tools that can alter behaviour, although they prompt rather different behavioural responses. For an increased replacement ratio and extended PBD in Austria in 1989, the authors observe an increase in unemployment duration, which is larger in case of a simultaneous increase in replacement rate and PBD compared to isolated increases in these UI parameters. Furthermore, they find a strong association between increases in PBD and exit rates from unemployment around the date of benefit expiration, while behavioural adjustments in response to an increase in replacement ratio follow a more uniform distribution over the unemployment spell.

Studying the unemployment incidence before and after the major reform of UB-1 in Germany in 2006, Dlugosz et al. (2014) apply a DID method and find decreased unemployment inflows for individuals aged 52 and older. Moreover, the results indicate large anticipation effects of the reform in the 3 months before the policy change came into force, which greatly distorted the short-term effects of the reform. Relative to younger workers, transition rates into

unemployment of workers aged 52 and older substantially increased in the anticipation period, which suggests a change in the composition of the unemployed in response to the reform. For a limited period right after the introduction of the reform, unemployment inflow decreased in a more pronounced way than in the absence of anticipation. This observation could be explained by the anticipation of dismissals and resignations from the post-reform period to the pre-reform one. Nevertheless, the decrease in unemployment inflows following the reform far outweighed the anticipation effect. Based on these findings, Lo et al. (2017) focus on the age group with the smallest anticipation effect, for which no systematic decrease in unemployment inflows after the reform has been observed. Furthermore, the authors exclude periods with unemployment inflows during the potential anticipation period to remove anticipation effects. Using a sample of male unemployed with full-time employment before unemployment, they distinguish between transitions to desired destinations such as non-low-wage full-time employment, transitions to less desired destinations such as subsidized self-employment, low-wage full-time employment and transitions to other states such as part-time employment, previous employer, secondary labor market or long training programs. The authors conclude that (non) low-wage workers tend to take up (non) low-wage employment. The probability of being recalled to the previous employer is higher for low-wage workers, while the probability to take up subsidized self-employment is higher for non-low-wage workers than for low-wage ones. Riphahn and Schrader (2020) also use a DID approach and find that affected older age groups have lower job exit rates, higher job finding rates, a higher probability to remain employed, and a lower probability to remain unemployed. Although the mentioned authors analyse the impact of the major reform of UB-1 in Germany in 2006 on transitions to important exit destinations, they disregard transitions to UB-2.

In the European context, the Finnish 1997 reform decreased PBD for older workers to enhance employment incentives and cut expenditures on unemployment indemnity. Kyyrä and Ollikainen (2008) apply a DID approach to analyse transitions to employment, which represent a targeted exit destination, and less desired transitions out of the labor force and into active labor market programs that are more relevant in the Nordic countries. Based on the altered flows into unemployment in anticipation of the policy change, the authors exclude the involved groups from the analysis. Their findings do not reveal large increases in the employment hazard around the date of benefits exhaustion. Instead, the hazard rates for labor market programs and non-participation present substantial rises. These results point to an important interaction between labor market institutions in which the UI system and the early retirement scheme represent an attractive pathway to labor market withdrawal prior to the regular old-age pension. The French reform of the UI system in 2003 also involved substantial shortenings in PBD for older workers (Fremigacci, 2010). The findings point to increased transition rates out of unemployment in response to the policy change. A decomposition of the outflows from unemployment allows a closer insight into the exit destinations. It reveals a positive, although tiny, effect on exits to employment, but a substantial positive effect on transitions to unemployment assistance, which is granted to individuals who have exhausted the UB or did not qualify to receive them. A common feature of the European institutions is the interaction of UI with other social security programs. Thus, upon exhaustion of UB, job seekers can shift to unemployment assistance or other basic income support programs. The author concludes that the major effect of the policy change in France was to shift job seekers from UB to unemployment assistance. These non-negligible transitions represent an unintended consequence of the reform that might limit the success of a policy change aiming to increase employment by reducing the generosity of the UI system (Pellizzari, 2006).

The shift to unemployment assistance following a reduction in PBD largely explains the identified spikes in exits from unemployment around the date of benefits exhaustion and supports the relevant work of Card et al. (2007) on the true mechanisms behind these spikes. In their study based on a large sample of job losers in Austria, Card et al. (2007) show that the observed spikes may exaggerate the extent of moral hazard induced by UI. The authors underscore the importance of how unemployment spells are measured (time spent on the unemployment system vs. time to next job), which determines the magnitude of the spikes at benefits exhaustion. The results indicate that the hazard rate of reemployment accounts only for a small part of the exit rate from registered unemployment. This finding reveals that many unemployed workers leave the unemployment register around the date of benefits exhaustion without returning to work, which sheds light on the divergence between the two measures of unemployment spell.

Whereas most studies look at rather short-term outcomes, Schmieder et al. (2012) apply a regression discontinuity design for Germany to examine the long-term impact of an extension of UI duration in the 1980s captured by the total days receiving UI benefits and the total days in nonemployment in the first 5 years after the start of the initial UI spell. The positive effect of longer UI duration on the sum of days spent in nonemployment combines the effect from the initial nonemployment spell and the incidence and duration of additional spells. Their results further indicate that a large part of the effect of UI extension is captured by a longer initial nonemployment spell and allowing for multiple spells reduces the impact of longer PBD. In other words, the effect of PBD on total nonemployment is smaller than the effect on the duration of the initial nonemployment spell. This implies that the long-term effect of UI on overall nonemployment is smaller.

The literature provides also evidence of strategic job search behaviour caused by more generous UB durations. For example, Lichter (2016) uses an exogenous variation in PBD originated from a policy change in Germany. The reform, implemented in 2008, involved an extension of PBD for workers of specific age groups. Applying a DID technique, the estimates provide causal evidence of reduced search effort, measured by the number of job applications and the probability of applying for jobs in distant areas, in response to the extension of PBD. These findings are in line with the theoretical predictions of standard job search models. Furthermore, instrumental variable estimates show that the reduction in search effort induced by the reform caused a significant decrease in the short-run job finding rate. Evaluated at the mean, a 10 percent increase in the number of filed applications is associated with an increase in the short-run job-finding rate by about 1.3 percentage points.

3 | INSTITUTIONAL SETTING

3.1 | The German unemployment compensation system

Similar to other European countries (e.g., Pellizzari, 2006), the unemployment compensation system in Germany relies on two main pillars, UB-1 ("Arbeitslosengeld 1") and UB-2 ("Arbeitslosengeld 2"). UB-1 is funded by employee and employer contributions and is administered by the Federal Employment Agency. All employees subject to social security contributions are covered by this UI. However, entitlement to UB-1 is conditioned on contribution to the insurance scheme for at least 12 months within the last 24 months before a job loss, and its duration depends on the age and employment history of unemployed workers. Monthly benefits replace 60 per cent (67 per cent for claimants with children) of the last net salary (capped at the

social security ceiling). Payments are usually annulled for up to 12 weeks if employees take the initiative to terminate the employment relationship, therefore reducing the maximum benefit duration. Furthermore, recipients of UB-1 are required to actively search for a job and to prove their job searching activities upon request from the local employment office. Lack of compliance with these requirements may lead to benefit cuts. Upon exhaustion of UB-1 or in case of no entitlement to them, needy unemployed jobseekers receive tax-financed UB-2, which is unconstrained by previous earnings and is granted without temporal restrictions. UB-2 is means-tested against household income and aims at providing a living at the subsistence level. Non-compliance with the rules can result in benefit sanctions that reduce the compensation level.

3.2 | The German reform of UB-1

We evaluate the major reform of UB-1 in Germany, originated from an institutional change called Hartz reforms, which have been part of the AGENDA 2010. The reform was implemented by law which passed parliament in December 2003 (Hartz IV law), and affected workers who lost their jobs after January 31, 2006. This major policy change implied a substantial reduction in the potential duration of UB-1 and largely annulled the extensions of the 1980s that were motivated by an increasing unemployment rate and long average spell duration among older workers in West Germany (Hunt, 1995). The core motivation of this reform was poor labor market performance of workers above 50 (Dietz & Walwei, 2011). Aiming at promoting reemployment among older workers, the introduced innovations were particularly penalizing for older workers with the maximum reduction in the PBD by 14 months, thus providing a great incentive to enter unemployment prior to February 1, 2006. In this respect, Dlugosz et al. (2014) find non-negligible evidence of anticipation behaviour among older workers in response to the reform.

The major UI reform lasted only until December 2007. In fact, very soon, the German government enacted some adjustments of the UI scheme, re-extending the PBD for older age groups. The law passed parliament in January 2008 and retrospectively affected all individuals unemployed on January 1, 2008 and thereafter. The main driving force were fairness considerations, according to which workers with contributions to the UI system for a longer period should be granted longer benefit durations. Nevertheless, this was a minor policy change that did not lead to the pre-reform state in terms of PBD. Table 1 illustrates the major and minor policy changes in the potential duration of UB-1 for each age category.

TABLE 1 Maximum duration (in months) of unemployment benefits in Germany

Age category	Before 2/2006	Reduction	2/2006–12/2007	Extension	Since 1/2008
<45	12	0	12	0	12
45–46	18	6	12	0	12
47–49	22	10	12	0	12
50–51	22	10	12	3	15
52–54	26	14	12	3	15
55–56	26	8	18	0	18
57	32	14	18	0	18
>57	32	14	18	6	24

The major reform in February 2006 also modified eligibility criteria and work history requirements for receipts of UB-1. Under the old regime, workers were eligible if they had worked at least 12 out of the 36 months preceding unemployment. After the reform, employment during at least 12 out of the last 24 months is required. Work history at the moment of the claim is crucial for qualification for the maximum benefit duration. Before the reform, individuals must have worked during the previous 84 months for a number of months equal to at least twice the PBD. Under the post-reform regime, they must have worked for a number of months equal to at least twice the PBD within the last 36 months prior to unemployment. The replacement rate for the level of benefits was not affected by the reform.

3.3 | Other relevant policy changes

UB-2 was introduced in January 2005. It largely replaced two previous components of the German unemployment compensation system, unemployment assistance ("Arbeitslosenhilfe"), granted to unemployed jobseekers upon exhaustion of UB, and social assistance ("Sozialhilfe"), granted to all other needy individuals, in particular to those who have never been employed. Further the "58 regulation", according to which older unemployed individuals (aged 58 and above) could receive UB without searching for a job, expired at the end of 2007 for those entering unemployment thereafter. Because this change was announced already in 2006, older workers might have had an incentive to enter unemployment before January 1, 2008. However, if they counted on another prolongation of this regulation, which was the case since 1985, the termination of the "58 regulation" is likely to have been anticipated only to a limited extent.

Apart from the reformed UI system, the German old age pension system has also been redesigned. In particular, until 2003, workers unemployed for at least 1 year after the age of 58.5 could take advantage of the early retirement scheme without pension shortenings at the age of 60. Since 2006, the minimum age to enter into pension due to unemployment increased gradually from 60 to 63 for birth cohorts 1946 and after, thus postponing early retirement. This implies that after 2006 several cohorts experienced not only a dramatical shortening of the UB duration but also a deferred entry into early retirement due to unemployment. Another pathway to retirement applies only to women. The birth cohorts till 1951 enjoyed the possibility to retire prematurely at age 60, as opposed to full retirement age above 60. Therefore, these women might be less responsive to the UI reform than men. Other retirement pathways, among which retirement after long-term employment and reduced earnings capacity pension available to workers with some health deficiency, remained unchanged during the period analysed in this paper. Finally, during the period under study, the state legal requirements for the approval of applications for medical rehabilitation have not been modified so that the pre- and post-reform participants in rehabilitation treatments do not systematically differ, leaving no room for a composition effect.

4 | DATA SET AND SAMPLES

For our analysis, we use the routine data collected by the German Statutory Pension Insurance,[3] which is the largest finance provider of medical rehabilitation treatments for employed individuals in Germany, followed by the statutory health insurance, and aims essentially at preventing

costs connected with early retirement following the principle of rehabilitation before pension. The German Statutory Pension Insurance (2014) alone approves more than one million applications for medical rehabilitation per year. The longitudinal data set includes a random sample of 20 per cent of all individuals who completed medical rehabilitation treatments granted by this insurer. A characterizing feature of medical rehabilitation consists in treating, among others, health deficiencies such as renal failure, disorders involving the metabolic and endocrine systems (e.g., diabetes mellitus), nervous system (e.g., migraine and sleep disorder), circulatory system (e.g., heart failure), respiratory system (e.g., asthma), digestive system (e.g., liver disorder), musculoskeletal system (e.g., back pain), mental and behavioural disorders (e.g., depression and alcohol abuse), and skin diseases (e.g., dermatitis). The most recurrent health disorder is low back pain, which in 2013 accounted for 31.5 per cent of all medical and other rehabilitative services provided by the German Statutory Pension Fund (German Statutory Pension Insurance, 2013). Scientific use files 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, SUF, 2012). The data set consists of three databases.

SUFRSDV09BYB: This pension insurance follow-up database provides information on insurance relationship and amount of contribution payments. Information on our outcome variables of interest such as number of worked days, days in UB-1, and days in UB-2 are also collected in the database.

SUFRSDV09MCB: It includes all cases with at least one completed medical rehabilitation, which in single cases may be supported by vocational rehabilitation and 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 and end of the treatment as well as its duration in days, rehabilitation region, and medical discharge diagnoses. Moreover, labor market variables at the start or shortly before the rehabilitation treatment are available such as employment status, most recent activity, and occupational status.

SUFRSDV09KOB: The database contains standard socio-demographic characteristics such as birth year, nationality, residence region, gender, marital status, and education.

We restrict our sample to individuals aged between 38 and 62 in the outcome years, which mitigates potential problems stemming from retirement decisions of older workers. Moreover, we only consider individuals who participated in only one medical rehabilitation in the observation period (approximately 75 per cent of the whole sample), either before the UB-1 reform or thereafter. In this way, the data set takes the form of pooled cross-sections with information before and after rehabilitation. Our dependent variables measure days in employment subject to social insurance contributions and days in registered unemployment with UB-1 or UB-2 in the outcome year. Non-employment, such as retirement due to health reasons or other labor market exits, and self-employment are not considered. Taking into account the timing of the reform of the old age pension system, we keep only individuals with completed rehabilitations between 2003 and 2008, for whom we can observe labor market outcomes in the years between 2004 and 2009. Observations with missing values are dropped. We consider three distinct samples.

Preferred Sample A: In our preferred sample A, we keep only years 2005 (pre-reform, rehabilitation in 2004) and 2007 (post-reform, rehabilitation in 2006) and focus on individuals employed before rehabilitation. This temporal restriction relies on the following considerations. First, UB-2 was introduced only in January 2005, while the potential duration of UB-1 was partially re-extended as early as in January 2008. The enacted policy changes prompt us to exclude

the years prior to 2005 and after 2007. Second, the exclusion of the year 2006 is motivated by the potential transition period and anticipation effects of the reform. Indeed, most individuals with completed rehabilitation in 2005 and days in UB measured in 2006 are more likely to have entered unemployment under the old regime. This is, however, not the case for rehabilitations finished in 2006, when the reform came into force. Although this restriction does not allow for controlling for pre-reform trends, it reduces distortions that stem from anticipation effects and further institutional changes. To check whether the common trend assumption holds in our data, we extend the considered time period to years between 2004 and 2009 in sample B. We further restrict our preferred sample A to those employed at least 12 months in the two calendar years before rehabilitation and the year of rehabilitation, i.e., during three calendar years before the outcome year. Although imperfect in its nature due to data construction, this restriction is supposed to approximate the sample's fulfilment of eligibility criteria to qualify for the PBD both under the old and the new regime. In practice, the PBD, for which an unemployed worker is entitled to, is calculated from his or her work history over a reference period just prior to job separation. In our data, however, we measure their labor market attachment within entire calendar years due to lack of information on age in months and precise work history of the unemployed at the date of unemployment entry. In line with Hunt (1995), who finds slightly larger coefficients when the treatment group is defined more accurately, our estimates should be interpreted as lower bounds for the treatment effects in the total population. The restrictions imposed on sample A reduce the total number of observations by less than 10 per cent and the number of observations adds up to 94,990. Table 2 shows the data structure for sample A.

Extended Sample B: We extend our preferred sample A to outcome years 2004–2009, which enables us to compare the pre-reform and post-reform trends and to verify the fulfilment of the common trend assumption. The final sample B consists of 306,230 observations.

Additional Sample C: As for Sample A, we keep only years 2005 and 2007, but we focus on individuals either unemployed or non-employed before rehabilitation. The subsample with the unemployed amounts to 15,857 observations, while that with the non-employed consists of 16,529 observations.

TABLE 2 Data structure (example for sample a: 2005/2007, employed before rehabilitation)

Year group	2002	2003	2004	2005 [pre-reform]	2006 [reform]	2007 [post-reform]
2005 (pre-reform)	sample restriction (full entitlement length): working days 2002/03/04 ≥ 365					
			• Employed • Rehabilitation • Rehabilitation exit	Outcomes		
2007 (post-reform)			Sample restriction (full entitlement length): working days 2004/05/06 ≥ 365			
					• Employed • Rehabilitation • Rehabilitation exit	Outcomes

5 | DID DESIGN AND VARIABLES

The major reform of UB-1 affected only individuals aged 45 years or older. The natural experiment setting allows us to apply a standard DID approach with assignment to treatment and control groups according to age. Thus, we compare the time trends in outcomes (pre-reform vs. post-reform) between unaffected individuals aged 38 to 44 years (control group) and affected individuals aged 45 to 62 years (treatment group). Differences in the time-trends are then assumed to be causally driven by the reductions in potential duration of regular UB for older workers. But the core identifying assumption in this DID approach is that time trends between control and treatment group do not differ before the reform was implemented. Because our preferred sample A only includes one pre-reform year 2005, we have checked the common trend assumption for our sample B with the pre-reform years 2004 and 2005 in more detail (including graphical illustrations) in Petrunyk and Pfeifer (2018). In this paper (see Section 6.2), we simply show that the pre-reform trends in our outcome variables do not differ between control and treatment groups in our DID regression framework.

The general estimation framework for our specification as described in Equation (1) can be estimated by using linear regressions with ordinary least squares (OLS). Note that a robustness check adopting count data models reveals virtually the same results as OLS. β_1 is the parameter for the treatment group specific effect (age trend), β_2 is the parameter for the time trend common to the control and the treatment groups, β_3 is the parameter of interest that provides the DID estimate of the average treatment effect on the treated (ATT), X is a vector of covariates defined below, α is a constant, and ε is the error term.

$$Y = \alpha + \beta_1 AGE + \beta_2 YEAR + \beta_3 AGE \times YEAR + \delta X + \varepsilon. \quad (1)$$

Outcome variables Y: Y denotes the outcome of interest measured in the calendar year[4] after medical rehabilitation and indicates days in UB-1, days in UB-2, and days in employment subject to social insurance contributions (WORK). They are aggregated for the complete calendar year from spell data and range from 0 to 365 days, providing information on the combined effect from the incidence and duration of recurring spells within a well-defined time period, thus capturing the reform effects that can go beyond the first unemployment spell. All three outcome variables are, of course, highly correlated with each other, because more working days, ceteris paribus, decrease the number of days in registered unemployment. Nevertheless, we think it is important to analyse all these outcome variables separately. In fact, the total number of days can not only be divided in employment and registered unemployment but also in other sources of non-employment (e.g., family responsibility, early retirement). Apart from non-employment, we further exclude self-employment, minor employment, and civil service. Unfortunately, the data do not include information about having different outcome status at the same day. For example, a person, who is coded as being in UB-1 at a given day in our data, can also receive specific benefits from the UB-2 system; but this person would be still subject to UB-1 benefits and affected by the reform. Moreover, unemployed persons can, for example, additionally take up a minor employment, which is however not part of our outcome variable WORK as it is not a regular employment subject to social insurance contributions. For our preferred estimation sample A (2005/2007, employed before rehabilitation), the number of days in UB-1 is on average 39.6, the number of days in UB-2 is 6.2, and the number days in employment is 261.7. Because our three outcome variables do not exhaust all possible labor market states, they do not sum up to 365 days.

Time period YEAR: The time period dummy *YEAR* captures aggregate factors that would cause changes in *Y* even in the absence of a policy change. In our preferred specification (sample A), we include only years 2005 and 2007 so that *YEAR* is a dummy for 2007, indicating the post-reform period. In the extended specification (sample B), we examine the pre-reform and post-reform trends for the years 2004 to 2009, testing for the common trend assumption. Here, *YEAR* is a set of dummy variables, whereby the year 2004 serves as the reference group.

Specifications AGE: The variable *AGE* captures possible differences between the treatment and control groups independent of the policy change. In a first step, the treatment group is defined by all individuals aged 45 or older and amounts to 77 per cent of individuals in our preferred sample A. Because reductions in the PBD implied by the policy change varied with respect to age categories, the treatment group is further separated according to these categories. Thus, individuals younger than 45 years still represent the control group and the treatment group age categories are 45–46, 47–51, 52–54, 55–56, and older than 56 years. Also note that workers older than 56 years might still have retirement decisions in their mind, whereas workers in the treatment group aged 45–56 years should not be affected by retirement considerations and potential adjustments in early and regular retirement legislations.

Control variables X: We account for differences in sex, marital status, nationality, education, job position, occupation, federal state, and rehabilitation diagnosis in our model. It is noteworthy to mention that our estimates of the treatment effect are largely unaffected by the inclusion of the control variables, which indicates that our estimates are likely to be unbiased. Table A1 in the Appendix offers a closer look at the descriptive statistics of all variables for our preferred estimation sample A (2005/2007, employed before rehabilitation). The results of the control variables are not further discussed.

6 | DID REGRESSION RESULTS

6.1 | Main results for 2005/2007

In our main analysis, we focus on sample A, i.e., on individuals who were employed before the rehabilitation and for whom we observe labor market outcomes in the pre-reform year 2005 and the post-reform year 2007. We use two different specifications of age (age treatment dummy for age ≥ 45, age treatment categories according to different reductions implied by the reform), which indicate the treatment assignment and are interacted with the post-reform year 2007 in our DID design.

Table 3 shows the regression results for the age treatment dummy, i.e., individuals younger than 45 years are the control group, and individuals equal to or older than 45 years are the treatment group. The general age trends (age ≥ 45) indicate that individuals equal to or older than 45 years have on average about 17.8 more days in UB-1, 6.5 fewer days in UB-2, and 25.3 fewer days in WORK than individuals who are younger than 45 years, which supports the view that older workers perform worse in the labor market. The general time trends (year2007) show that individuals in 2007 have on average about 6.7 fewer days in UB-1, 5 fewer days in UB-2, and 10.6 more days in WORK than individuals in 2005, which might be driven by the overall labor market reforms induced by AGENDA 2010 and Hartz reforms. The treatment effects (age $\geq 45 \times$ year2007) of the reduction of the potential duration of UB-1 indicate on average

TABLE 3 Results for age treatment dummy (sample a: 2005/2007, employed before rehabilitation)

	(1) UB-1	(2) UB-2	(3) WORK
Age ≥ 45	17.80 [0.97]***	−6.51 [0.59]***	−25.29 [1.57]***
Year 2007	−6.66 [1.01]***	−4.96 [0.67]***	10.56 [1.79]***
Age ≥ 45 × year2007 (post-reform)	−10.50 [1.22]***	4.65 [0.72]***	13.57 [2.06]***
Control variables	Yes	Yes	Yes
R^2	0.11	0.07	0.19
Mean dep. variable	39.58	6.15	261.68
N	94,990	94,990	94,990

Note: Sample A (2005/2007, employed before rehabilitation). Outcome variables are days per calendar year. Ordinary least square regressions. Robust standard errors in brackets.
Abbreviation: UB, unemployment benefits.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

about 10.5 fewer days in UB-1, 4.7 more days in UB-2, and 13.6 more days in WORK for affected individuals in the post-reform year 2007. The treatment effects are statistically significant and sizeable. If we put the absolute treatment effects simply in relationship to the sample mean outcomes, days in UB-1 have decreased by about 25 per cent, days in UB-2 have increased by about 75 per cent, and days in WORK have increased by about 5 per cent. It should be kept in mind that our estimates for a sample of individuals with health impairments does not provide the treatment effect for the entire eligible population. Also note that the treatment effects on our three outcome variables do not sum up to zero, because our three outcome variables do not exhaust all possible labor market states. In particular, we focus only on employment subject to social insurance contributions, excluding self-employment, minor employment, and civil service. Moreover, we exclude non-employment such as retirement due to health reasons or other labor market exits.

In the next step, we replace the age treatment dummy with age treatment categories, i.e., we split the treatment group into age categories according to the different reductions of the potential duration of UB-1 induced by the reform (see Table 1 in Section 3.2).[5] The results in Table 4 support the previous findings. Older workers have on average more days in UB-1, fewer days in UB-2, and fewer days in WORK. Days in UB-1 and UB-2 are lower, and days in WORK are larger in 2007 than in 2005. More importantly, the treatment effects have the same signs as before. The different age categories allow us to further analyse how far the treatment effects differ within the treatment group of older workers. The reference group is the control group consisting of individuals younger than 45 years. The treatment effects are four fewer days in UB-1 for the age group 45 to 46, which experienced a reduction of potential duration of UB-1 by 6 months. For the age group 47 to 51 (reduction by 10 months), the treatment effect is eight fewer days in UB-1. The age groups 52 to 54 (reduction by 14 months) and 55 to 56 (reduction by 8 months) each have a treatment effect of about nine fewer days in UB-1. The largest treatment effect is estimated for the age group older than 56 (reduction by 14 months), which has about 14 fewer days in UB-1. The treatment effects on days in UB-2 do not differ that strongly and range between three more days in UB-2 for the youngest treatment age group (45–46) and six more days in UB-2 for the oldest age treatment group (age > 56). Days in WORK have increased for the age group 45 to 46 by 8 days, for the age group 47 to 51 by 6 days, for the age group 52 to 54 by 13 days, for the age group 55 to 56 by 16 days, and for the age group older

TABLE 4 Results for age treatment categories (sample a: 2005/2007, employed before rehabilitation)

	(1) UB-1	(2) UB-2	(3) WORK
Age 45–46	4.00 [1.58]*	−3.08 [0.95]**	−5.32 [2.62]*
Age 47–51	9.74 [1.24]***	−5.55 [0.70]***	−4.58 [1.95]*
Age 52–54	13.74 [1.46]***	−6.32 [0.73]***	−15.94 [2.23]***
Age 55–56	18.08 [1.69]***	−7.08 [0.78]***	−32.55 [2.53]***
Age > 56	35.45 [1.40]***	−8.90 [0.63]***	−60.08 [2.03]***
Year 2007	−6.61 [1.01]***	−4.97 [0.67]***	10.46 [1.79]***
Age 45–46 (reduction −6 months) × year 2007 (post-reform)	−4.44 [2.00]*	2.56 [1.19]*	7.72 [3.47]*
Age 47–51 (reduction −10 months) × year 2007 (post-reform)	−7.87 [1.54]***	4.30 [0.87]***	5.88 [2.55]*
Age 52–54 (reduction −14 months) × year 2007 (post-reform)	−9.28 [1.79]***	4.04 [0.90]***	12.68 [2.91]***
Age 55–56 (reduction −8 months) × year 2007 (post-reform)	−9.04 [2.12]***	4.86 [0.99]***	15.85 [3.36]***
Age > 56 (reduction −14 months) × year 2007 (post-reform)	−14.22 [1.78]***	5.75 [0.79]***	17.16 [2.70]***
Control variables	Yes	Yes	Yes
R^2	0.12	0.07	0.20
Mean dep. variable	39.58	6.15	261.68
N	94,990	94,990	94,990

Note: Sample A (2005/2007, employed before rehabilitation). Outcome variables are days per calendar year. Ordinary least square regressions. Robust standard errors in brackets.
Abbreviation: UB, unemployment benefits.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

than 56 by 17 days after the reform. Overall, we can conclude that the treatment effects on days in UB-1, days in UB-2, and days in WORK are significant for all age treatment categories and that the absolute treatment effects are larger for older individuals, for whom the treatment intensity (reduction) is larger.

In Petrunyk and Pfeifer (2022), we extend the standard binary DID approach by replacing the interaction term between age treatment categories and the post-reform year by a treatment intensity variable, which measures the reduction in PBD after the reform. The overall results are consistent with the results reported in this section. The reduction in potential duration of UB-1 by 1 month decreases UB-1 on average by more than 0.6 days per year, increases UB-2 on average by about 0.3 days per year, and increases WORK on average by more than 0.8 days per year.

6.2 | Pre-reform and post-reform trends for 2004–2009

Crucial for a causal interpretation of treatment effects in DID designs is the parallel (common) trend assumption, i.e., the time trends must not differ between control groups (age < 45) and

TABLE 5 Results and trends for age treatment dummy (sample B: 2004–2009, employed before rehabilitation)

	(1) UB-1	(2) UB-2	(3) WORK
Age ≥ 45	17.52 [0.94]***	−5.39 [0.43]***	−28.72 [1.48]***
Year2005	−3.73 [1.09]***	4.08 [0.68]***	4.84 [1.84]**
Year2006	−8.17 [1.04]***	5.27 [0.69]***	12.26 [1.79]***
Year2007	−10.34 [1.01]***	−0.98 [0.56]	15.33 [1.75]***
Year2008	−9.31 [1.01]***	−2.81 [0.51]***	15.48 [1.74]***
Year2009	−6.31 [1.04]***	−1.85 [0.54]***	9.06 [1.76]***
Age ≥ 45 × year2005	0.38 [1.33]	−1.27 [0.72]	3.61 [2.13]
Age ≥ 45 × year2006	3.35 [1.29]**	−1.05 [0.74]	4.61 [2.07]*
Age ≥ 45 × year2007 (post-reform)	−10.14 [1.21]***	3.43 [0.61]***	17.17 [2.01]***
Age ≥ 45 × year2008 (post-reform)	−10.99 [1.20]***	4.38 [0.55]***	19.74 [2.00]***
Age ≥ 45 × year2009 (post-reform)	−12.61 [1.22]***	3.61 [0.58]***	23.25 [2.00]***
Control variables	Yes	Yes	Yes
R^2	0.11	0.06	0.18
Mean dep. variable	40.47	5.51	261.43
N	306,230	306,230	306,230

Note: Sample B (2004–2009, employed before rehabilitation). Outcome variables are days per calendar year. Ordinary least square regressions. Robust standard errors in brackets.
Abbreviation: UB, unemployment benefits.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

treatment groups (age ≥ 45) in the absence of the reform to estimate unbiased treatment effects, which are the coefficients of the interaction terms between treatment groups and post-reform years. To check the pre-reform and post-reform trends, we repeat the analysis for the years 2005 and 2007 (Sample A, employed before rehabilitation) from the previous section with the full set of years from 2004 to 2009 (Sample B, employed before rehabilitation). Table 5 shows that the treatment effects are only observed in the post-reform years and not in the pre-reform years, which supports the parallel trend assumption. More specifically, the coefficients of the interaction term between age ≥ 45 and the pre-reform year 2005 do not differ significantly from zero and from the reference year 2004, whereas the coefficients of the interaction terms between age ≥ 45 and the post-reform years 2007, 2008, and 2009 differ significantly from zero and from the pre-reform years 2004 and 2005. The coefficients of the interaction term between age ≥ 45 and the year 2006, in which the reform was implemented, are either not significant or relatively small in magnitude. It is noteworthy that the treatment effect in the year 2006 on UB-1 is positive, although small with 3.4 days, instead of negative. But this finding is consistent with an anticipation effect that reasoned our decision to focus on the years 2005 and 2007 in our preferred sample A. Because we do not find evidence for a violation of the parallel trend assumption and can identify a structural break between pre-reform years (2004–2006) and post-reform years (2007–2009), we are confident that our estimated treatment effects are not a statistical artefact.

6.3 | Gender and regional differences for 2005/2007

Gender differences in labor market attachment, earnings, and retirement decisions are well known. These differences can lead to lower monetary UB payments (for the same UB duration and replacement rate) for women and heterogenous treatment effects between men and women. Riphahn and Schrader (2020) report, for example, that women react more strongly than men to the 2006 reduction in UB duration in Germany with respect to transitions between employment and unemployment states, even though they expected that men react more strongly. Moreover, Caliendo et al. (2013) find that men with shorter benefit duration accept less stable and lower paying jobs after the reform, but women do not. Lopes (2022) finds in a literature survey that estimates of the relationship between unemployment and UB duration are higher for women than men, which is, according to her, consistent with lower labor market attachment of women.

Another source of heterogenous treatment effects might be the region, in which a worker lives. Because East Germany had an almost 10 percentage point higher unemployment rate than West Germany prior to the reform, finding a job might have been be harder; hence, we would expect a less strong reaction to reduced UB duration in East Germany. Contrarily, jobs in East Germany pay on average lower wages so that incentives to take up work might have been lower and, hence, increasing work incentives by shortening PBD might lead to a stronger reaction in East Germany than in West Germany.

To check for potential gender and regional differences, we split our preferred sample A (2005/2007, employed before rehabilitation) between men and women (see Table 6) as well as between West (including Berlin) and East German Federal States (see Table 7). The results for the separate samples support our previous findings for the complete sample in Section 6.1. The small gender and regional differences[6] indicate, if anything, that the reform affected women and people living in East German Federal States slightly more positively, i.e., days in UB-1 decreased and days in WORK increased even more, whereas days in UB-2 did not increase that much.

TABLE 6 Results men versus women for age treatment dummy (sample a: 2005/2007, employed before rehabilitation)

	Men			Women		
	(1) UB-1	(2) UB-2	(3) WORK	(1) UB-1	(2) UB-2	(3) WORK
Age ≥ 45	18.21 [1.32]***	−6.89 [0.79]***	−28.79 [2.11]***	17.35 [1.44]***	−6.15 [0.88]***	−20.65 [2.36]***
Year2007	−7.96 [1.36]***	−5.44 [0.90]***	13.85 [2.37]***	−4.91 [1.53]**	−4.50 [1.01]***	6.15 [2.70]*
Age ≥ 45 × year 2007 (post-reform)	−8.76 [1.64]***	5.70 [0.97]***	10.13 [2.76]***	−12.76 [1.83]***	3.48 [1.09]**	17.77 [3.10]***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.12	0.08	0.20	0.11	0.07	0.18
Mean dep. variable	39.66	6.14	260.02	39.49	6.16	263.59
N	50,903	50,903	50,903	44,087	44,087	44,087

Note: Sample A (2005/2007, employed before rehabilitation). Outcome variables are days per calendar year. Ordinary least square regressions. Robust standard errors in brackets.
Abbreviation: UB, unemployment benefits.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

6.4 | Unemployed and non-employed before rehabilitation for 2005/2007

In the previous sections, we focused on individuals who were employed before medical rehabilitation. These individuals make up the majority of the complete sample. But they might also be a positive selection and their decisions to enter unemployment are likely to be more important than their decisions to exit unemployment for our analysed labor market outcome variables. To give a more complete picture of the labor market reform, we repeat our previous analyses for individuals who were unemployed and non-employed before the medical rehabilitation

TABLE 7 Results West versus East for age treatment dummy (sample a: 2005/2007, employed before rehabilitation)

	West			East		
	(1) UB-1	(2) UB-2	(3) WORK	(1) UB-1	(2) UB-2	(3) WORK
Age ≥ 45	16.60 [1.06]***	−6.74 [0.63]***	−23.53 [1.71]***	23.44 [2.44]***	−5.32 [1.60]***	−33.36 [3.95]***
Year2007	−6.48 [1.11]***	−4.48 [0.73]***	10.29 [1.95]***	−7.72 [2.52]**	−7.58 [1.73]***	11.73 [4.52]**
Age ≥ 45 × year2007 (post-reform)	−10.15 [1.33]***	4.85 [0.78]***	12.68 [2.25]***	−12.07 [3.06]***	3.78 [1.87]*	18.31 [5.18]***
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.11	0.08	0.18	0.14	0.06	0.22
Mean dep. variable	38.73	5.92	262.93	43.83	7.31	255.43
N	79,098	79,098	79,098	15,892	15,892	15,892

Note: Sample A (2005/2007, employed before rehabilitation). Outcome variables are days per calendar year. Ordinary least square regressions. Robust standard errors in brackets.
Abbreviation: UB, unemployment benefits.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

TABLE 8 Results unemployed versus non-employed before rehabilitation for age treatment dummy (sample C: 2005/2007)

	Unemployed			Non-employed		
	(1) UB-1	(2) UB-2	(3) WORK	(1) UB-1	(2) UB-2	(3) WORK
Age ≥ 45	31.34 [2.25]***	−26.95 [3.88]***	−14.55 [2.45]***	20.83 [2.74]***	−23.86 [3.36]***	0.34 [3.96]
Year2007	−17.17 [2.20]***	14.30 [4.84]**	20.39 [3.41]***	−13.94 [2.67]***	−1.79 [3.78]	30.52 [4.46]***
Age ≥ 45 × year 2007 (post-reform)	−5.94 [2.93]*	9.62 [5.53]	−2.05 [3.77]	−9.93 [3.27]**	18.98 [4.21]***	−12.67 [5.07]*
Control variables	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.12	0.23	0.20	0.07	0.27	0.35
Mean dep. Variable	55.93	159.31	42.86	47.47	61.23	146.31
N	15,857	15,857	15,857	16,529	16,529	16,529

Note: Sample C (2005/2007, unemployed and non-employed before rehabilitation). Outcome variables are days per calendar year. Ordinary least square regressions. Robust standard errors in brackets.
Abbreviation: UB, unemployment benefits.
*$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

(sample C, 2005/2007). The overall effects are less positive for these unemployed and non-employed samples than for individuals who were employed before medical rehabilitation. Table 8 shows average treatment effects for the unemployed sample of about six fewer days in UB-1, 10 more days in UB-2, and two fewer days in WORK, of which only the estimated treatment effect for days in UB-1 is statistically significant at $p < 0.05$. The average treatment effects for the non-employed sample indicate about 10 fewer days in UB-1, 19 more days in UB-2, and 13 fewer days in WORK. Thus, the decreased days in UB-1 are largely due to a slip into UB-2 and the reform seems to even have a negative effect on WORK in the unemployed and non-employed samples.

7 | DISCUSSION AND CONCLUDING REMARKS

Our paper evaluates the major German reform of regular UB-1, enacted in February 2006. The policy change induced a substantial reduction in the PBD for older workers, thus alleviating the disincentive effect of long compensation provided by the UI system. Our estimation results, based on a DID approach, reveal for our preferred sample of individuals, who were employed before medical rehabilitation, that days in UB-1 decrease on average by 10.5 and days in employment increase on average by 13.6 due to the reduction in PBD, which hints at the intended reform effect. However, our analysis also indicates that days in unemployment assistance (UB-2), which is granted to unemployed jobseekers without temporal restrictions upon exhaustion of UB-1, increase by 4.7. From a social policy perspective, transitions to UB-2 (instead of employment) upon exhaustion of UB-1 denote a rather unintended consequence of the reform, limiting the success of a policy change that aims to increase employment by reducing the generosity of the UI system. An additional analysis of individuals, who were unemployed or non-employed before medical rehabilitation, provides additional insights. The intended reform effects of fewer days in UB-1 and more days in employment are much smaller and the unintended effects of transitions to UB-2 are much larger for the unemployed and non-employed samples than for individuals who were employed before medical rehabilitation.

Our sample consists only of individuals with some health deficiency who participated in a medical rehabilitation program. One could argue that treatment effects of the reform for this group might be smaller than for healthy workers with no need for medical rehabilitations, because individuals with no health impairment might be more responsive to UI incentives (Charles, 2003; Colella & Bruyère, 2011; Mok et al., 2008). In this case, our treatment effects could be interpreted as lower bounds. But such an argumentation remains vague without an explicit evaluation and comparison of individuals with health impairments and healthy workers. Nevertheless, we compare our results to those in Schmieder et al. (2012), who study the effects of an extension of UB for older workers in Germany on the number of days with receipt of UI benefits over 5 years with representative data. The authors find that an extension of UB by 6 months led to an increase of about 68 days within 5 years or equivalently almost 14 days per year. Thus, a 1-month extension results on average in 2.3 more days per year with receipt of UI benefits, which is a larger treatment effect than we have found. Our results (Table 4) indicate a range of 9 to 14 fewer days per year in UB-1 for reductions of UB durations between 8 and 14 months. Approximately, a 1-month reduction results on average in only one fewer day per year in UB-1 or, alternatively, a 1-week reduction in 0.25 fewer days. Note, however, that Schmieder et al. (2012) analyse an extension of UB duration in the 1980s, whereas we analyse a reduction in 2006. In a recent literature survey, Lopes (2022, p. 9) concludes: "The

range of the average effect, for countries that estimated a significant impact, is widely spread and lies between 0.02 and 1.3 additional weeks of unemployment duration, for each additional week of unemployment benefits." The average estimates in the reviewed studies in Lopes (2022) are approximately 0.3 and comparable in size with our estimate.

In addition to the rather standard result that unemployment length increases with the potential duration of UB, our results also indicate the risk of a slip down in unemployment assistance after a reduction of UB duration, which is more severe for individuals with worse labor market prospects. Overall, our results hint at the importance to design labor market reforms in a wider framework of institutional interactions. In fact, a common feature of the European institutions is the interaction of UI with other social security programs (e.g., Fremigacci, 2010; Pellizzari, 2006). If the objective of policy-makers is to discourage moral hazard behaviour via shortening the duration of UB, a broader consideration of individual labor market prospects of more vulnerable workers upon exhaustion of regular UB seems appropriate. Otherwise, exits from unemployment to non-employment as well as shifts from UB to unemployment assistance or other welfare programs can undermine intended positive reform effects.

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ENDNOTES

[1] See Petrunyk et al. (2015) and Reichert et al. (2015) for a more detailed description of medical rehabilitation in Germany and its determinants.

[2] See Petrunyk and Pfeifer (2018) for a more comprehensive review of the literature. A recent review on the elasticity of unemployment duration to the potential duration of unemployment benefits can be found in Lopes (2022).

[3] While the administrative data from the Sample of Integrated Labour Market Biographies (SIAB) contain daily spell information on employment periods subject to social security contributions, job search periods, participation in active labor market programs, and claim periods of UB-1 as well as UB-2, the advantage of our data over the SIAB data consists in the availability of information on individuals' health limitations and other important control variables.

[4] The outcome year is always a complete calendar year, i.e., a one-year period beginning on January 1 and ending on December 31. Moreover, the outcome year is always the year after the medical rehabilitation has been completed, i.e., rehabilitation exit has officially been registered until December 31 in the year before the outcome year.

[5] In Petrunyk and Pfeifer (2018), we present graphical illustrations of the treatment effects for each year of age, i.e., for interaction terms with all age dummies and the post-reform year 2007. The results support the results for more aggregated age groups reported in this paper.

[6] Estimates from the models with a triple interaction term (age $\geq 45 \times$ year2007 $\times$ female and age $\geq 45 \times$ year2007 $\times$ East, respectively) suggest that these differences are not statistically significant.

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APPENDIX A

TABLE A1 Summary statistics (sample a: 2005/2007, employed before rehabilitation)

	M	*SD*	Min	Max
Outcome variables (*Y*)				
Days UB-1 in calendar year (UB-1)	39.5784	93.0501	0	365
Days UB-2 in calendar year (UB-2)	6.1490	40.7390	0	365
Days employed in calendar year (WORK)	261.6766	151.7951	0	365
DID variables (*AGE*, *YEARS*)				
Age in years	50.4924	6.5965	38	62
Age $\geq$ 45 (affected by reform)	0.7744			
Year2005 (pre-reform)	0.4811			
Year2007 (post-reform)	0.5189			
Control variables (*X*)				
Female (dummy)	0.4641			
Maritalstatus (dummies)				
Single (reference group)	0.1254			
Married	0.7147			
Divorced	0.1312			
Widowed	0.0287			
Nationality (dummies)				
Germany (reference group)	0.9429			
Italy, Spain, Greece, Portugal	0.0108			
Former Yugoslavia	0.0122			
Turkey	0.0145			
Other EU and non-EU country	0.0167			
Stateless, unknown	0.0029			
Education (dummies)				
Unknown, not applicable (reference group)	0.1747			
Low/ medium secondary schooling degree without apprenticeship	0.1288			
Low/ medium secondary schooling degree with apprenticeship	0.6062			
High secondary schooling degree without apprenticeship	0.0039			
High secondary schooling degree with apprenticeship	0.0261			
University of Applied Science degree	0.0292			
University degree	0.0311			
Jobposition (dummies)				
Unknown, not applicable (reference group)	0.0034			
Apprentice	0.0006			
Unskilled blue-collar worker	0.1076			
Low skilled blue-collar worker	0.1020			
Skilled blue-collar worker	0.2724			

(Continues)

TABLE A1 (Continued)

	M	*SD*	Min	Max
Master craftsman, foreman	0.0132			
White-collar worker	0.4955			
Civil servant	0.0004			
Self-employed	0.0047			
Occupation in ... (dummies)				
Unknown, not applicable (reference group)	0.0621			
Agriculture, forestry and fishing	0.0124			
Mining and quarrying	0.0036			
Manufacturing	0.0332			
Metal-making and metal-working	0.1236			
Textile-making and textile-processing	0.0056			
Accommodation and food service activities	0.0255			
Construction	0.0885			
Professional, scientific, and technical activities	0.0555			
Trade and transportation	0.1846			
Administrative and support service activities	0.2059			
Health care	0.1144			
Teaching and training	0.0244			
Other	0.0607			
Federal state (dummies)				
Berlin (reference group)	0.0428			
Schleswig Holstein	0.0287			
Hamburg	0.0159			
Lower Saxony	0.0998			
Bremen	0.0060			
Northrhine-Westphalia	0.2032			
Hesse	0.0740			
Rhineland Palatinate	0.0471			
Baden-Wurttemberg	0.1419			
Bavaria	0.1596			
Saarland	0.0137			
Brandenburg	0.0319			
Mecklenburg-West Pomerania	0.0222			
Saxony	0.0537			
Saxony-Anhalt	0.0260			
Thuringia	0.0336			
Rehabilitation diagnosis (dummies)				
166 medical diagnoses				

Note: Sample A (2005/2007, employed before rehabilitation). Number of observations $N = 94{,}990$.
Abbreviations: DID, difference-in-differences; UB, unemployment benefits.