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EARLY DETERMINANTS OF WORK DISABILITY IN AN INTERNATIONAL PERSPECTIVE

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ABSTRACT

This paper studies the interrelated roles of health and welfare state policies in the decision to take up disability insurance (DI) benefits due to work disability (WD), defined as the (partial) inability to engage in gainful employment due to physical or mental illness. We exploit the large international variation of health, self-reported WD and the uptake of DI benefits in the US and Europe using a harmonized data set with life history information assembled from the Survey of Health Ageing and Retirement in Europe (SHARE), the English Longitudinal Study on Ageing (ELSA) and the Health and Retirement Study (HRS). Particular attention is given to the role of life-time health and other life-time experiences in explaining WD and DI uptake later in life. We find that while our large set of health measures explains a substantial share of the within-country variation in WD and DI, this is not the case for the variation across countries. Rather, most of the variation between countries is explained by differences in DI policies.

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A data appendix is available at http://www.nber.org/data-appendix/w25142

1. Introduction

Work disability (WD) is the (partial) inability to engage in gainful employment due to physical or mental illness, resulting in early retirement and/or uptake of disability insurance benefits (Loisel and Anema 2014). Disability insurance (DI) is a substantial part of public social expenditures and an important part of the social safety net of all developed countries (OECD 2003, 2010). The design of work disability insurance systems is a challenging task for policy makers (Havemann and Wolfe 2000; Autor and Duggan 2003, 2006, 2010; de Jong et al. 2011). Like almost all elements of modern social security systems, disability insurance faces a trade-off (Aarts et al. 1996, Diamond and Sheshinski 1995, Banks et al. 2004, Croda and Skinner 2009, Autor et al. 2016). On the one hand, disability insurance is a welcome and necessary part of the social safety net as it prevents income losses for those who lose their ability to work before they become eligible for old-age pensions. On the other hand, disability insurance may be (mis-)used as an early retirement route even if the ability to work is not limited.

Both self-reported WD and DI uptake vary substantially between countries. While around 25% of the respondents between age 50 and 65 report suffering from a disability that limits their working capacity, this percentage is much lower in Italy (around 10%) but almost three times that size in Germany and the USA. Similarly, the share of individuals receiving DI benefits ranges from around 3-5% in Italy, France and Switzerland to about 20% in Sweden and the Czech Republic.[1]

The aim of this paper is to shed light on the interrelated roles of health and welfare state policies in the decision to take up DI due to work disability. Regarding health, we especially focus on health over the entire life course. The key idea of the paper is to exploit the large variation of the potential causes for reporting a WD and/or receiving DI benefits within and between countries.

A first and obvious potential cause for reporting a WD and/or receiving DI benefits is current health. Heterogeneity of mortality and morbidity in Europe is very large both across and within countries. Life expectancy at birth of women in the EU varies between 86.3 years in Spain and 78.5 years in Bulgaria, and for men between 81 years in Italy and 69.2 years in

[1] Based on SHARE, ELSA and HRS data. Details will be explained below.

Lithuania.[2] While Swedish and Italian men have about the same life expectancy (80.6 and 81 resp.), Swedish men spend more than five additional years in good health than their Italian counterparts: the gap in healthy life expectancy is 73.0 versus 67.6 years.[3] Health varies strongly by income and other socio-economic characteristics (European Union 2013). Health is more heterogeneous in the US, Germany and the Mediterranean countries than in Scandinavia (Avendano et al. 2009).

Second, there is ample evidence that good health in later life emerges from a person's biological make-up, behavior, lifestyle, environmental and occupational conditions, health care interventions, and a multitude of interactions between these factors across the entire life span. An important insight of recent research is that these interactions manifest their effects starting very early in life and then accumulate in positive and negative feedback cycles over the entire life course (Power and Kuh 2006, Heckman and Conti 2013). Life-course factors are therefore a second group of potential causes for reporting a WD and/or receiving DI benefits.

Third, welfare-state policies, especially the design of the pension and DI systems, have been shown in the country studies edited by Gruber and Wise (1999, 2004) and Wise (2012, 2015) to create strong incentives on individuals' labor market and retirement behavior. Thus, differences in policies could also explain the large international variation in DI uptake rates.

The paper continues and expands our research on early retirement and disability insurance in Europe and the US (Börsch-Supan and Schnabel 1998, Börsch-Supan et al. 2004, Börsch-Supan 2010, 2011, Börsch-Supan and Roth 2011, Börsch-Supan and Jürges 2012). This paper improves on our earlier work in four important respects. First, we systematically juxtapose self-reported work disability with the uptake of DI. We find systematic international differences in the match between WD and DI.

Second, we stress the importance of life-course events. To this end, we have constructed an internationally harmonized data set assembled from the US Health and Retirement Study (HRS), the English Longitudinal Study on Ageing (ELSA) and the Survey of Health, Ageing and Retirement in Europe (SHARE) in which particular attention has been given to lifetime health and other lifetime circumstances using the life history data from SHARE and ELSA

[2] Eurostat (2016a)

[3] Eurostat (2016b)

plus comparable early childhood and life-course data from HRS. We find that health problems experienced over the life course even as early as during childhood are important drivers of later life working capacity and the need to rely on DI benefits.

Third, there have been incisive reforms to the DI systems in many of the countries analyzed in earlier studies. Most have significantly reduced the generosity of DI. In contrast to earlier papers based on cross-sectional data, we are able to exploit these policy changes thanks to our life history data. We can match the policy environment at the point in time, when DI benefits were received for the first time. While the most striking international differences in DI generosity have been abolished, we still find a strong response of DI uptake to DI generosity that is identifiable even on the individual level.

Finally, we take account of measurement issues, potential biases and reverse causality. Self-reported WD may be biased towards worse health outcomes since the respondent may feel urged to justify his or her enrolment in DI in spite of a good health status (Bound 1991; Kerkhofs and Lindeboom 1995, Dwyer et al. 2003). In turn, self-reports may also be positively biased due to accommodation (Hill et al. 2016). Self-reported general health is subject to similar measurement errors (Butler et al. 1987) and reporting biases (Dwyer and Mitchell 1999, Benitez-Silva et al. 2000). We deal with these by including more objectively measured health indicators which are included in SHARE, ELSA and HRS. They include grip strength for upper-body physical health, EURO-D for depression, the sum of immediate and delayed word recall for memory abilities, and the number of limitations in the (instrumental) activities of daily living (ADL, IADL) which measure functional health. Nevertheless, we will be careful in making causal attributions. In order to deal with reverse causality problems, we exploit information about life health and use time as an identifying instrument, made possible thanks to our life history data. These variables measure health at childhood as well as episodes of ill health during the entire life course. In this way we pick up health problems that occur well before the onset of WD and DI receipt.

The paper proceeds as follows. In Section 2 we present the data and the harmonized variables. In Section 3 we describe our empirical methodology. In Section 4 and 5 we present our empirical results. We first focus on explaining the within-country variation in work disability and disability receipt (Section 4). We then use counterfactual simulations to explain the between-country variation (Section 5). Section 6 concludes and points out directions for future research.

2. Data

2.1 SHARE, ELSA and HRS

We use harmonized data from three sister studies on aging: The Survey of Health, Ageing and Retirement in Europe (SHARE), the Health and Retirement Study (HRS) and the English Longitudinal Study of Ageing (ELSA). SHARE is a pan-European data set designed to analyze the process of population aging using cross-national comparisons within Europe and between Europe, America and Asia (Börsch-Supan et al. 2013). SHARE is modeled closely after the US Health and Retirement Study (Juster & Suzman 1995), which was the first survey of this kind, and the English Longitudinal Study of Ageing (Marmot et al. 2003), which followed the lead by HRS. Harmonization allows for cross-country comparisons in cultures, living conditions and policy approaches between Europe, the UK and the US if the information is sufficiently harmonized (King et al. 2004). The potential of combining these datasets has not fully been exploited so far. Harmonization involves extensive data manipulation due to the often subtle differences in variable definitions across the three data sets. The data sets and the exact harmonization procedures are described in detail in the Technical Appendix B.

We use the following waves of data: HRS - Wave 11, collected in 2012/13; ELSA - Wave 6, collected in 2012/13; SHARE - Wave 5, collected in 2013. For some variables, we merge information from previous waves, e.g. for marital status and education (see Table B. 3 for details). A key feature of our harmonized data set is the availability of retrospect life history data about the onset of a work disability, the receipt of DI benefits, episodes of bad health, and other events that may explain WD and the receipt of DI benefits. Some of this information is available in the regular surveys. For some additional life history variables we add information from SHARE Wave 3, ELSA Wave 3 and similar questions in HRS.[4] Due to the combination of datasets we include thirteen countries in most of our analyses: Austria, Germany, Sweden, the Netherlands, Spain, Italy, France, Denmark, Switzerland, Belgium, the Czech Republic, the UK, and the US.

[4] Life histories are highly structured computer-assisted interviews which collect retrospective data on the most salient health, family, social, work, accommodation, and economic events from childhood to current age (Belli 1998). For more details see Appendix B.

We restrict our analysis to individuals in an age range in which disability insurance occurs most frequently. Due to the age focus of all three studies age 50 serves as the lower age bound in our analysis. In most countries disability insurance benefits are automatically converted into old-age pension benefits, thus, our upper age bound is the country specific statutory retirement age.[5] The upper age bound ranges between 60 years and 66 years for some cohorts in the US.

SHARE wave 5 covers 20,428 individuals within this age range. ELSA includes 11,585 and HRS 3,751 individuals. After deleting observations with missing information for the dependent variables or the main health indicators, the remaining sample consists of 30,131 observations in total. The number of observations included in our regressions varies depending on the included control variables; especially the life course indicators are only available for subsamples.

2.2 Variables

Dependent variables: For our analysis we use two different dependent variables: self-rated work disability (WD) and the receipt of disability benefits (DI). WD captures the self-assessed work disability based on the question: *"Do you have any health problem or disability that limits the kind or amount of paid work you can do?"* The second dependent variable DI is defined as receiving disability insurance benefits or not. Disability insurance is defined as all branches of publicly financed insurances providing compensation in case of the loss of the ability to perform gainful employment (see Table A. 3 for the country specific details). Both variables are binary. We observe 7,041 individuals (23.4%) who report WD and 3,252 individuals (10.8%) who receive DI benefits.

In addition to that we use an extensive set of individual level and country level control variables. The following groups of covariates are generated for the analyses:

[5] For the definition of the statutory retirement ages we gather information on the national pension systems. We create a binary variable indicating whether someone is above or below the national statutory retirement age taking into account transitional arrangements of pension reforms separately for men and women (see Table A. 2 in the Appendix).

Demographics: We use gender and the respondents' age at the time of the interview. The current marital status is split into the categories married, divorced, widowed or single.[6] We include three categories of the highest educational attainment based on the ISCED[7] coding (low education (0-2), medium education (3-4), high education (5-6)).

Health: We use the respondent's self-reported health status rated on a categorical five-point scale from excellent (1) to poor (5). Self-reported health is among the most common measures used in public health surveys; it captures various physical, emotional, social aspects of health and wellbeing and has been found to predict mortality (see, e.g. Idler and Benyamini 1997, Jylhä 2009). Additionally, we include the objectively reported health information on the number of limitations with (instrumental) activities of daily living (ADL and IADL). In order to take a person's mental wellbeing into account, we construct the EURO-D depression index based on the number of reported depressive symptoms in SHARE.[8] We complement these health measures by information from the physical test measuring the maximal grip strength of a person. Grip strength is our most objective measure of health since the task is performed during the interview. It reflects the overall muscle status of the respondent and has been linked to mortality in previous research (see, e.g., Gale et al. 2007). We impute missing values for grip strength by setting them to zero implying that the missing values originate from situations where persons are not able to perform the grip strength test due to frailty. We add an additional flag variable to control for these imputed values. Further, we include a cognition measure based on a verbal learning and recall test performed during the interview.

Life course health: We create the sum of all childhood illnesses the respondents had until they were 16 years old, covering infectious diseases, asthma, respiratory diseases, allergies, headaches, epilepsy, psychological problems, diabetes, heart problems, cancer, fractures and ear problems. The variable adulthood diseases is created accordingly and contains the sum of illnesses since the year of 16 including: back pain, arthritis, osteoporosis, angina heart

[6] Since information on the marital status is only given if something changed since the last interview, we merge information from all previous waves. The same applies for the educational level.

[7] International Standard Classification of Education

[8] In ELSA and HRS, another depression index called CES-D score is used. SHARE contains the information needed for both the EURO-D and the CES-D score in wave 1. Based on this information we build a prediction rule for EURO-D by means of a linear regression and apply this rule to the HRS and ELSA data to obtain the predicted EURO-D scores.

diseases, diabetes, stroke, asthma, respiratory problems, headaches, cancer, psychiatric problems, fatigue, allergies, eyesight problems, and infectious diseases.

Employment history: We use different variables from the life histories in ELSA and SHARE in order to describe the employment history of a respondent. The number of jobs during the work history is constructed by summing up the employment spells (start and end of job). We also consider the situation between different employment spells and count all times of being sick or disabled as the number of working gaps. We further take into account whether the respondent had periods of ill health or disability that lasted for more than a year.

Childhood circumstances: The socio-economic status during childhood is measured by the number of books and the number of rooms in the accommodation at the age of ten.

Table B. 1 provides an overview of the variables used and Table 1 presents the summary statistics and some basic correlations.

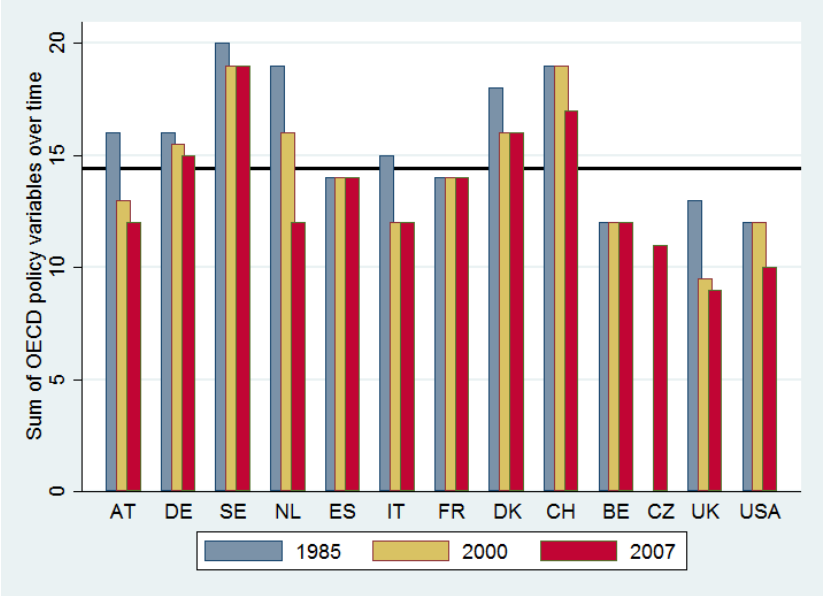
Policy indicators: We complement the individual level data with macro-economic indicators. Specifically, we merge data on disability policy indicators provided by the OECD (2003, 2010). These indicators measure the degree of compensation in different DI benefit systems on the basis of the following five characteristics: **Coverage** (ranging from the total population to employees only); **Minimum disability level** (lower bound ranging from 0% to 86%); **Maximum benefit level** (in terms of replacement rate ranging from RR<50% to RR>=75%), **Medical assessment** (ranging from treating doctor only to teams of insurance doctors); **Vocational assessment** (ranging from strict own-occupation assessment to all jobs available). Each indicator is measured according to a predefined scale ranging from zero points (restrictive) to five points (generous). The **sum of the indicators** is used as covariate in the regression analyses to account for country differences in the generosity of DI benefit systems. The indicators are available for three points in time: around 1985, 2003 and 2007 (see Table A. 1). We match the year of first DI benefit receipt of our individuals with these three time periods in order to approximate the policy circumstances of the respective time period as well as possible.

In Figure 1we show how the level of generosity of the DI systems changed between 1985 and 2007 by plotting the summarized OECD indicators for the different countries. Overall, the

sum of the OECD policy indicators decreases over time in almost all countries, meaning that in general the systems have become less generous reflecting the incisive reforms mentioned in the introduction. The exceptions are Spain, France and Belgium, where the overall level of generosity remains stable over time. Sweden, Denmark and Switzerland reveal high OECD policy scores at all points in time reflecting above-average generosity of their DI systems. In contrast, four countries remain below the average generosity level: Belgium, the UK, the US and the Czech Republic. Some countries started with an above average level of generosity like for example the Netherlands and Austria, but show below average levels of DI benefit generosity today.

In our regression analyses we will include the summary score and alternatively the five sub-scales as explanatory variables.

Figure 1: Generosity of DI systems over time and by countries



Source: Own calculation based on OECD (2003, 2010)

3. Methodology

Our analysis is divided into two parts: first, an analysis of the within-country variation in WD and DI benefit receipt and second an analysis of the between-country variation of WD and DI benefit receipt.

The objective of the first set of analyses is to understand at the individual level whether a person has work disabilities and receives DI benefits and relate this to the different variable groups, namely demographics, current health, life course health and other life course variables, and the DI policy regimes. We do this by pooling the data from all countries and performing probit and linear regression analyses. We are particularly interested in the role of life course health and other life course variables, since they can give some indications of which life time factors contribute to whether people suffer from limitations on their earnings capacity later in life and have to rely on DI receipt. We assess how much of the total variation in WD and DI benefit receipt at the individual level is explained by the different sets of variables.

Second, we try to explain the cross-national variation in WD and DI receipt. The overall objective is to understand whether differences in the demographic structure, health or institutions etc. can explain differences in the level of work disability and DI receipts between countries. To do so, we perform counterfactual simulations which hold some of the explanatory variables constant. We equalize the cross-national differences in demographics, health, life course circumstances and policy characteristics stepwise and predict how work disability and DI enrolment rates would look like if the variable groups were identical across countries. If the equalized group of variables were the main cause for the international variation, the simulated outcome should produce roughly identical percentages of work disability and DI benefit rates in each country.

4. Empirical results

4.1 WD and DI receipt

We start our analysis by describing the characteristics of our sample. 23.4% of the respondents report suffering from a disability that limits their working capacity and around 10.8% of the total sample receives DI benefits (Table 1). The correlation between the two variables is high: among those with DI more than 80% report a health problem that limits their work capacity and among those not receiving DI benefits only 16.5% report such limitations. On the other hand, among those with a health problem 37% receive DI benefits, while among those without health problems only 3% receive DI benefits.

Figure 2 shows the extent of work disability (WD) and disability insurance (DI) receipt in 13 different countries in Europe and the US. In all countries except Sweden the average rate of self-reported WD is higher than the share of persons who receive DI. The variation between countries is high. The rate ranges from around 10.5% in Italy to around 29% in Germany and the USA. Additionally there is substantial variation in the share of individuals with DI benefits. The share ranges from around 3-5% in Italy, France and Switzerland up to 20% in Sweden and the Czech Republic. While in almost all countries, there are more individuals reporting WD, there are marked cross-national differences in the relative size of the WD and DI populations. In Sweden, these populations are about equal, while in France, there are about five times as many individuals reporting a WD as receiving DI.

Figure 2: Work disability and disability insurance receipt in Europe and the US

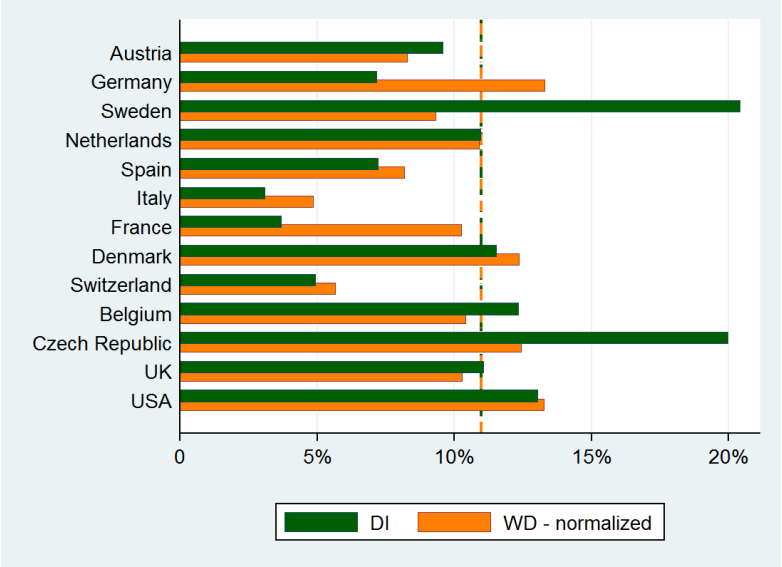
Source: Own calculations based on weighted data from SHARE Wave 5, ELSA Wave 6, HRS Wave 11.

Table 1: Summary statistics and basic correlations

	Categories	Share of total sample	WD=0	WD=1	DI=0	DI=1
DI	No DI	89.21%	83.5%	16,48%		
	Receiving DI	10.79%	19.7%	80.32%		
WD	No WD	76.63%			97.23%	2.77%
	Reporting WD	23.37%			62.90%	37.10%
Age	50-55	32.35%	79.06%	20.94%	90.57%	9.43%
	56-60	40.02%	76.93%	23.07%	89.00%	11.00%
	61-66	27.64%	73.37%	26.63%	87.91%	12.09%
Gender	Male	46.04%	77.74%	22.26%	89.37%	10.63%
	Female	53.96%	75.69%	24.31%	89.07%	10.93%
Education	Low	25.00%	71.00%	29.00%	84.95%	15.05%
	Medium	43.29%	75.00%	25.00%	88.59%	11.41%
	High	29.78%	83.74%	16.26%	93.76%	6.24%
Marital status	Single	9.26%	69.34%	30.66%	81.32%	18.68%
	Married	72.31%	79.69%	20.31%	91.83%	8.17%
	Divorced	13.65%	68.76%	31.24%	83.03%	16.97%
	Widowed	4.78%	66.97%	33.03%	82.44%	17.56%
Number of jobs	0-2	26.38%	72.24%	27.76%	86.60%	13.40%
	3-4	13.52%	77.81%	22.19%	90.45%	9.55%
	5-6	5.50%	74.15%	25.85%	88.29%	11.71%
	>7	2.63%	77.30%	22.70%	88.78%	11.22%
Self-reported health	excellent	12.33%	96.31%	3.69%	97.50%	2.50%
	very good	26.61%	92.87%	7.13%	96.83%	3.17%
	good	36.04%	81.99%	18.01%	92.72%	7.28%
	fair	18.95%	49.82%	50.18%	77.08%	22.92%
	poor	6.07%	17.43%	82.57%	56.01%	43.99%
Number of limitations IADL	0	90.72%	81.02%	18.98%	91.99%	8.01%
	1	6.12%	42.62%	57.38%	68.98%	31.02%
	2	1.59%	17.92%	82.08%	55.21%	44.79%
	>3	1.56%	15.07%	84.93%	41.61%	58.39%
Number of limitations ADL	0	91.25%	81.72%	18.28%	92.04%	7.96%
	1	4.59%	32.51%	67.49%	67.34%	32.66%
	2	1.83%	18.87%	81.13%	56.44%	43.56%
	>3	2.32%	9.43%	90.57%	46.86%	53.14%
Grip strength	0-20	4.24%	52.27%	47.73%	75.74%	24.26%
	20-50	45.83%	78.47%	21.53%	90.15%	9.85%
	40-60	27.23%	82.07%	17.93%	91.90%	8.10%
	>60	2.02%	86.56%	13.44%	94.43%	5.57%
EURO-D	0	22.65%	91.98%	8.02%	96.45%	3.55%
	1-2	44.84%	82.29%	17.71%	92.35%	7.65%
	3-4	19.43%	65.74%	34.26%	84.08%	15.92%
	5-6	9.20%	50.85%	49.15%	75.41%	24.59%
	>7	3.88%	37.35%	62.65%	69.06%	30.94%
Recall abilities	0-5	6.52%	62.16%	37.84%	79.25%	20.75%
	6-10	41.52%	73.34%	26.66%	86.91%	13.09%
	11-15	45.00%	80.57%	19.43%	92.02%	7.98%
	16-20	6.96%	84.40%	15.60%	94.04%	5.96%
Childhood illnesses	0	14.19%	79.44%	20.56%	92.47%	7.53%
	1-2	77.49%	77.86%	22.14%	89.65%	10.35%
	3-4	7.45%	62.76%	37.24%	81.38%	18.62%
	>5	0.86%	40.00%	60.00%	63.46%	36.54%
Adulthood illnesses	0	44.78%	88.96%	11.04%	95.19%	4.81%
	1-2	43.92%	73.30%	26.70%	88.37%	11.63%
	3-4	9.43%	44.83%	55.17%	72.03%	27.97%
	>5	1.86%	19.82%	80.18%	51.96%	48.04%

Since self-reported WD and state-regulated DI receipt are two very different concepts. Figure 3 normalizes the two underlying scales to have a common average value. Assuming that self-reported WD has the same scale in each country (a strong assumption, cf. Sen 2002, Kapteyn et al. 2007), the result may be interpreted as relative match quality. After the normalization, in many countries the rates of self-reported work disability and DI benefit receipt match each other more or less. There are a couple of exceptions: Sweden and the Czech Republic appear very generous in granting DI benefits. Here DI benefit rates are much higher than the rates of self-reported disability. The opposite is the case for France and Germany, where the fraction of persons with self-reported disabilities is much higher than those receiving DI benefits. In Denmark, the Netherlands, the UK and the US the rates are about the same.

Figure 3: Work disability and disability insurance receipt (normalized)

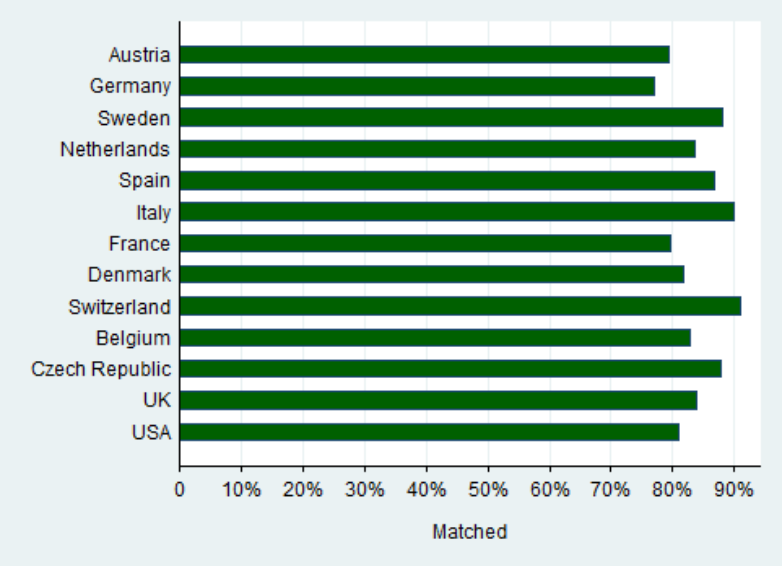


Source: Own calculations based on weighted data from SHARE Wave 5, ELSA Wave 6, HRS Wave 11.

Figure 4 and 5 take a different look by basing the comparison between WD and DI on each individual. If all DI systems would work perfectly we should see a perfect match between work disability and disability receipt. I.e. everyone with a limitation should receive benefits and nobody without a limitation should receive benefits (assuming that there are no reporting errors in WD and DI receipt). In our sample of 30,131 individuals in 13 countries, 83.2% are matched in the sense that they have a WD and receive DI (8.7%) or have no WD and do not receive DI (74.5%). However, at the same time about 14.7% of individuals report a WD but receive no DI benefits. In turn, 2.1% receive DI benefits but do not report any WD.

If there are a lot of individuals who receive benefits without having limitations then the system is either too generous or prone to abuse. If there are many individuals who receive no benefits despite a limitation then the system is probably not targeting the persons in need very well. Figure 4 shows the frequency of a match, which is highest in Switzerland and Italy (around 90%) and lowest in Germany (77%).

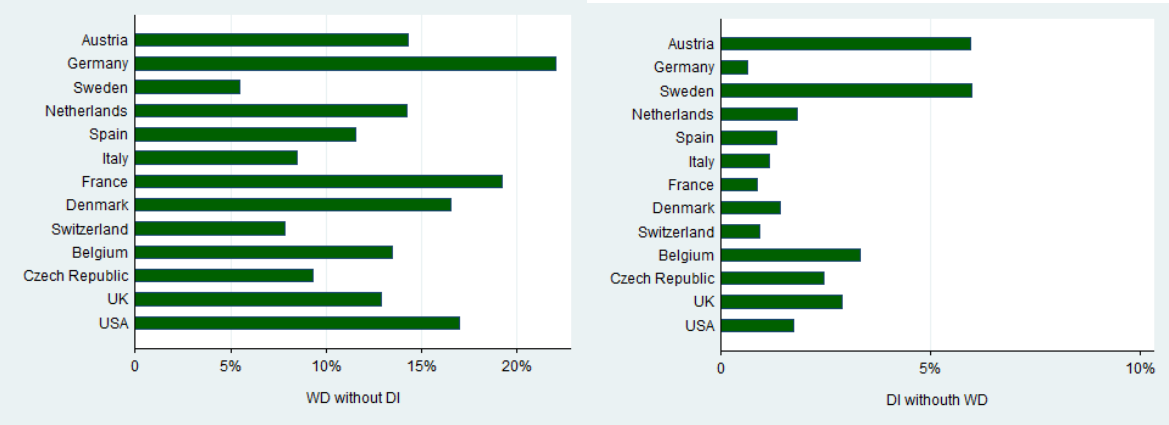
Figure 4: Match between work disability and disability insurance receipt



Source: Own calculations based on weighted data from SHARE Wave 5, ELSA Wave 6, HRS Wave 11.

Figure 5 (left) displays the fraction of individuals with work limitations that do not receive DI benefits. Germany, France, the US, and Denmark stand out with a fraction of individuals that report WD and do not receive DI benefits which is above 15% of the population. The rate in Germany is particularly high: Almost 22% of the respondents self-report a disability which prevents them from working full-time while they do not receive DI benefits. In contrast to that in Sweden, Switzerland and Italy this first type of mismatch is lowest. In turn, Sweden and Austria give about 6% of all individuals aged between 50 and 65 DI benefits while these respondents do not claim any limitation in their ability to work (Figure 5 - right).

Figure 5: Work disability but no disability insurance receipt (left); disability insurance receipt but no work disability (right)



Source: Own calculations based on weighted data from SHARE Wave 5, ELSA Wave 6, HRS Wave 11.

What explains the high variation in work disability and disability insurance receipt? In order to understand this, in a next step, we will examine what causes the high variation in the prevalence of WD and which factors can explain why DI is taken up so much more frequently in some countries than in others.

4.2 WD and DI across socio-demographic characteristics

Table 1 shows how WD and DI vary by socio-demographic characteristics. We complement these bivariate correlations by multivariate regression analyses. Since both variables of interest – WD and DI – are binary, we estimate probit models (Table 2). We report average marginal effects. We include demographic variables and a set of subjective and objective current health indicators, life course health, and DI policy indicators. The full models explain 30% and 23% of the total variation for WD and DI receipt, respectively.

We see the following patterns. WD as well as DI benefits receipt increase with age. However, this correlation disappears when health is taken into account (Table 2). Women are more likely to report a work limitation but DI benefit receipt is almost equal among men and women. Conditional on other variables, however, women are less likely to self-report a work disability and also have a lower probability of receiving DI benefits. This is in line with previous findings (OECD 2003) and can be explained by a lower labor market participation of women in general and the fact that many countries have lower eligibility ages for early retirement for women compared to men. Thus, for them alternative routes to early retirement are available.

There is a clear education gradient for both variables in the bivariate statistics: Among those with low education more persons report work disability and receive DI (29.0% and 15.0%, respectively) than in the middle (25.0% and 11.4%, respectively) and high education group (16.3% and 6.2%, respectively). However, the gradient become much less pronounced when controlling for differences in health (see Table 2). Education does not matter for determining work disability reports, when controlling for health. However, the higher the education level, the smaller is the probability of receiving DI benefits. This can be explained by the different occupational types. If disability benefits are granted also on the basis of the fact that a specific job can still be done, then those in low skilled but physically demanding jobs are more likely to be granted benefits.

The marital status seems to play an important role for the receipt of DI benefits. In the group of married persons only 8.7% receive DI, whereas in the other groups (singles, widowed, divorced) around 17%-19% are enrolled in DI benefits. The pattern remains in the multivariate regressions. This can be explained by the fact that in some countries (e.g. Portugal, Denmark and Belgium) disability benefits are means-tested and the income of the partner is taken into consideration. Married individuals are also less likely to report WD compared to single, divorced and widowed persons. Here the reasons could be related to selection effects and healthier lifestyles among married individuals.

As expected, all health variables are strongly related to reporting work disability and receiving DI pensions. The worse the health category is, the more persons are restricted and receive an income replacement. The share of persons with work disability and receiving DI is especially high for low categories of self-reported health measures (self-reported health, ADL, IADL). A bad health status according to objective health measures reveals also a higher share of individuals with WD and more DI recipients (grip strength, recall abilities). Multivariate regressions show substantial and significant relations between DI and WD and all health indicators, except for recall abilities. The fact that more objective health measures like grip strength, and the EURO-D depression scale also significantly influence the WD and DI likelihood is a particularly interesting result since the subjective health measure as well as the ADL, IADL measures are more likely to be plagued by justification bias (Kerkhofs and Lindeboom 1995). This is much less so the case for grip strength and the depression scale as these measures are not self-reported but measured during the interview.

Table 2: Determinants of WD and DI

		WD	DI
Demographics	Age	0.001	0.000
		(0.001)	(0.001)
	Female	-0.027	-0.035
		(0.006)**	(0.004)**
	Education_high	-0.014	-0.038
		(0.010)	(0.013)**
	Education_medium	0.003	-0.014
		(0.010)	(0.010)
	Single	0.023	0.053
		(0.006)**	(0.007)**
	Divorced	0.037	0.047
		(0.007)**	(0.005)**
	Widowed	0.026	0.039
		(0.015)	(0.012)**
Health	Self-reported health	0.109	0.046
		(0.014)**	(0.010)**
	ADL	0.067	0.016
		(0.012)**	(0.003)**
	IADL	0.026	0.021
		(0.009)**	(0.002)**
	Grip strength	-0.001	-0.002
		(0.000)**	(0.000)**
	Grip strength missing	-0.036	-0.046
		(0.019)	(0.013)**
	EURO-D	0.014	0.005
		(0.001)**	(0.001)**
	Recall abilities	0.000	-0.001
		(0.001)	(0.001)
Life health	Childhood illnesses	0.019	0.015
		(0.004)**	(0.003)**
	Adulthood illnesses	0.043	0.023
		(0.004)**	(0.004)**
Policy	OECD sum score	0.010	0.011
		(0.005)*	(0.005)*
	Pseudo R2	0.30	0.23
	N	30,131	30,131

Note: * $p<0.05$; ** $p<0.01$; Marginal effects after of probit estimation. Standard errors in parentheses, clustered standard errors by country. Based on HRS, ELSA and SHARE including the following countries: AT, DE, SE, NL, ES, IT, FR, DK, CH, BE, CZ, UK, USA.

Current or very recent health measures, as broadly as they may be measured, may not appropriately capture the full impact of poor health on employability. Work disability may rather be the result of a long lasting process of becoming sick and finally unable to work. This analytical part of our project will take a life-course approach and exploit the life-course variables in SHARE, ELSA and HRS that account for long-run effects. We include lifetime health indicators that describe childhood and adulthood health status in our regression. The

life course health variables are highly significant determinants of reported WD and the receipt of DI benefits even after controlling for current health. Among those who report more than five childhood illnesses 60% report WD and 36.5% receive DI at older ages. Among those with more than five adulthood illnesses 80.2% report WD and 48.1% currently receive DI benefits. The relationships remain strong and significant even when controlling for current health status. Thus, health problems experienced over the life course and even as early as childhood are important drivers of later life working capacity and the need to rely on DI benefits. This is an important result for two reasons. First, from a methodological point of view, health indicators measured as early as childhood are much less likely to be endogenous to labor market outcomes due to the time sequence of events. Thus, the measured effects can more convincingly be interpreted causally. Second, from a policy perspective health interventions that target children when young do not only matter for their health at that point in time but have (positive) long-term impacts for health and labor market participation later in life. In addition, we take other life-course features into account such as childhood socio-economic status, quality of the working place and marital status over the whole life course. The analyses will follow in the next section, since we have to rely on a substantially smaller sample for those analyses.

Finally, we would like to have a look at the institutional indicators.[9] The OECD score describing the generosity of the disability pension system is an important determinant for WD and DI benefit receipt. If the score increases by one point on average the probability of receiving a DI pension increases by around 1%.[10]

4.3 Variance decomposition

In order to understand the contribution of different variable groups of explaining the variation in WD and DI receipt we perform a variance decomposition analysis.[11] Figure 6 (left) shows the variance decomposition of the individual variation in self-assessed work disability. The

[9] Clustered standard errors account for the fact that these variables vary across countries only.

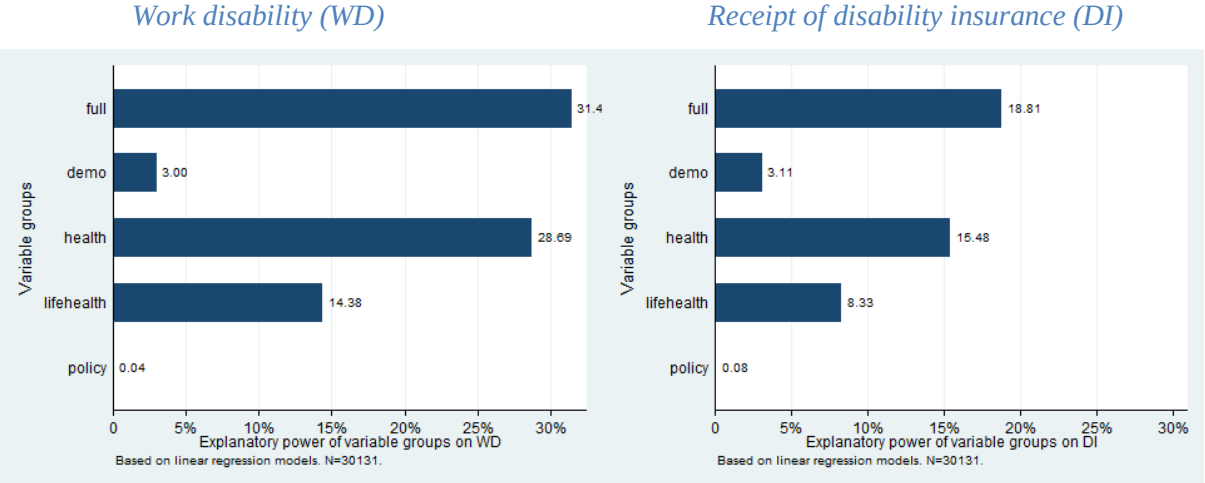
[10] As a robustness check we run a probit regression with country-fixed effects instead of the OECD variables. As expected, the results for the other variable groups remain stable in size and sign. Results are reported in Table A. 5 in the Appendix. We also ran a regression where we control for the five individual OECD indicators describing the DI pension systems. Results are reported in Table A. 6 in the Appendix.

[11] The decomposition is based on linear regression models presented in Table A. 4. The linear specification gives very similar results as the probit model presented before.

explanatory power of the full model is 31%. Most of the variation in WD (29%) can be explained by current health status. The second most important variable group consists of the life course health indicators. They can explain 14% of the total variation, indicating that health problems that occur early in life matter a lot for work disabilities later in life. Demographics (3%) have only small explanatory power for individual level work disability. And the DI policy variables do not seem to matter at all, when analyzing individual WD.

Figure 6 (right) shows how much of the variation in DI benefit receipt is explained by each variable group. The full model explains 19% of the variation in the data which is less than in the case of self-assessed work disability. However, the overall pattern is rather similar. The most important determinant of DI benefit receipt is individual's current health: 15% of the variation is explained by the individual health variables. Health over the life course is also important. These variables explain 8% of the total variation in benefit receipt. Basic demographics account for only 3% of the variation. The policy indicators explain less than 1% of the individual variation in benefit receipt.

Figure 6: Variance decomposition for the probability of reporting WD and receiving DI benefits



Source: Own calculations based on weighted data from SHARE Wave 5, ELSA Wave 6, HRS Wave 11.

4.4 The role of life course circumstances

As mentioned in the introduction, work disability may be the result of a long lasting process and therefore demographics and current health measures might not appropriately capture the effect on work disability. We already showed in our previous analysis that health conditions

during childhood and adulthood matter a lot for work limitations and disability benefit receipt later in life. However, we would like to add a layer of complexity and therefore include additional life course variables about early childhood conditions and the work history. These variables are only available for SHARE and ELSA and only for respondents having participated in both wave 3 and wave 5/wave 6 of SHARE and ELSA respectively, which leads to a substantial reduction in our sample size to 4,703 observations. The regression results are shown in Table 3.

In addition to the socio-demographics, the health and the life health indicators, we include the number of gaps in the working history in which a person was sick or disabled. The results are positively significant and as expected: The more working gaps due to sickness someone experienced during their career, the higher the probability of reporting work disability and of receiving DI benefits later in life. We further include a binary variable indicating if someone had suffered from an extended period of poor health, which also has a positive and significant effect on both dependent variables. The number of jobs during the working life in general does not have a significant effect on WD. However, individuals with a particularly low number of jobs have a high likelihood of receiving DI benefits probably because they left the labor market early in their career. The socio-economic status during childhood is measured by the number of books and the number of rooms per person in the accommodation. These indicators of early childhood socio-economic circumstances are not related to work disability or DI receipt. However, we already control for childhood health which might be the more important indicator of the situation in which individuals grew up, that is related to the health and working life situation when old.

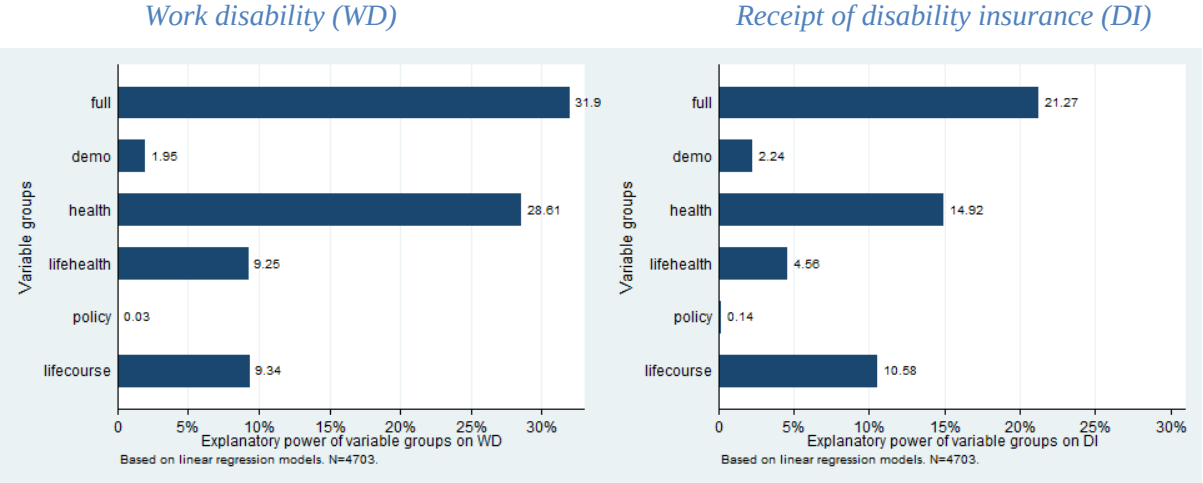
Table 3: The effect of additional life course variables on WD and DI receipt

		WD	DI
Demographics	Age	0.002	-0.002
		(0.002)	(0.002)
	Female	-0.003	-0.046
		(0.017)	(0.015)**
	Education_high	-0.017	-0.021
		(0.010)	(0.019)
	Education_medium	-0.009	-0.011
		(0.012)	(0.012)
	Single	0.017	0.047
		(0.015)	(0.016)**
	Divorced	0.018	0.029
		(0.016)	(0.017)
	Widowed	-0.058	0.027
		(0.025)*	(0.022)
Health	Self-reported health	0.119	0.047
		(0.009)**	(0.007)**
	ADL	0.071	0.013
		(0.011)**	(0.005)**
	IADL	0.045	0.027
		(0.028)	(0.010)*
	Grip strength	-0.001	-0.002
		(0.001)	(0.001)**
	Grip strength missing	-0.027	-0.038
		(0.026)	(0.021)
	EURO-D	0.011	0.003
		(0.002)**	(0.003)
	Recall abilities	0.001	-0.003
		(0.002)	(0.001)*
Life health	Childhood illnesses	0.019	0.002
		(0.003)**	(0.005)
	Adulthood illnesses	0.028	0.012
		(0.008)**	(0.006)*
Policy	OECD sum score	0.006	0.007
		(0.004)	(0.004)
Life course	Working gaps	0.080	0.066
		(0.026)**	(0.022)**
	Periods of poor health	0.039	0.037
		(0.006)**	(0.004)**
	Low nr. of jobs	-0.013	-0.036
		(0.012)	(0.012)**
	High nr. of jobs	0.014	0.004
		(0.009)	(0.008)
	Childhood nr. rooms	-0.001	-0.001
		(0.003)	(0.003)
	Childhood nr. books	0.003	0.001
		(0.005)	(0.004)
	Pseudo R2	0.32	0.25
	N	4,703	4,703

Note: * $p<0.05$; ** $p<0.01$; Marginal effects after probit estimation. Standard errors in parentheses, clustered standard errors by country. Based on ELSA and SHARE including the following countries: AT, DE, SE, NL, ES, IT, FR, DK, CH, BE, CZ, UK.

In Figure 7, we present the results of the variance decomposition. The full models including the additional life course indicators explain 32% (21%) of the total variance in case of WD (DI). As before the variables measuring current health are the most important determinants of work disability and DI benefit receipt. In case of WD life course health and other life course indicators are about equally important, both sets of variables explain about 9% of the total variance each. In case of DI benefit receipt the life course indicators are even more important than the life health indicators. They account for 11% of the total variance.

Figure 7: Variance decomposition for the probability of reporting WD and receiving DI benefits



Source: Own calculations based on weighted data from SHARE Wave 5, ELSA Wave 6, and SHARE Wave 3 and ELSA Wave 3.

Overall, we find that individual experiences over the life course are important drivers of WD and DI benefit receipt later in life. This means that individual health, working conditions and the institutional environment that influences health and working conditions early in life, matter for health and working capacity later in life. Individuals who were sick during childhood and adulthood, and who have interrupted working careers due to health problems are very likely to report a reduced working capacity later in life and rely on DI benefits.

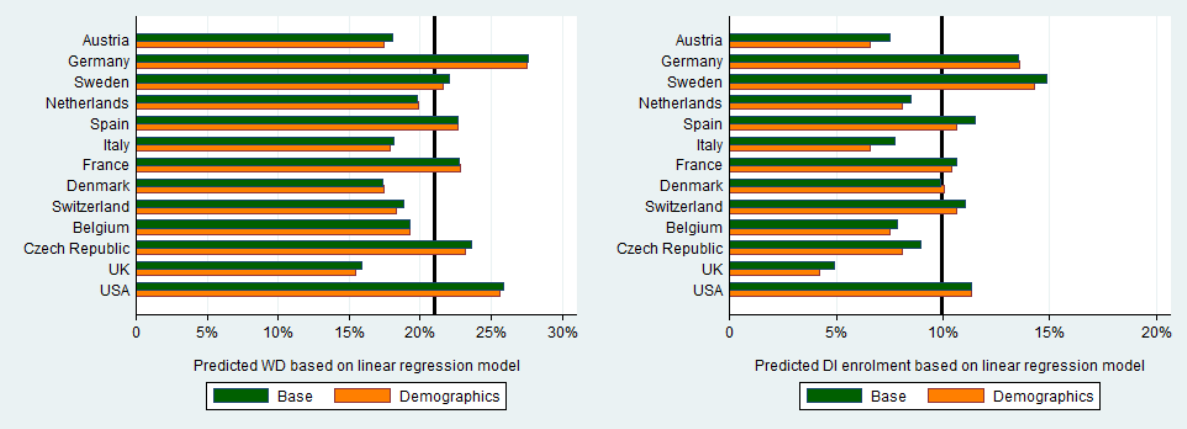
5. Counterfactual simulations to explain the between-country variation in WD and DI

Finally, we would like to understand why there are so large differences in WD and DI enrolment rates between countries? While health explains a great deal of the within-country variation in early retirement at any point in time, there is hardly any relationship between

disability benefit receipt and average population health in a cross-national perspective (Börsch-Supan 2005). Moreover, there is hardly any time series correlation between old-age labor force participation and objective measures of population health such as mortality rates (Börsch-Supan and Jürges 2012). In this section we analyze the between-country variation in WD and DI enrolment rates. In order to do this, we run the same regressions as reported in Table 2 and use them to predict average DI and WD rates by country. For the baseline prediction we use all variables as they are. For the counterfactual simulations we set specific variable groups (demographics, health, policy indicators) to the average for all countries. Italy, for instance, has an older population than the European average, while Denmark has a younger population. In the counterfactual simulations below we take out these demographic differences. In this way we predict which share of our sample would report a WD and take up DI benefits if everybody had the same characteristics as the average of all countries.

In Figure 8 we compare the counterfactual simulation results if all demographics are set to the averages with the baseline results. Taking account of demographic differences between countries does not make a substantive difference neither in the DI enrolment rates nor in the self-assessment of WD. Therefore demographic differences across Europe and the US can be ruled out as the main cause of the between-country variation.

Figure 8: Counterfactual simulation for demographics

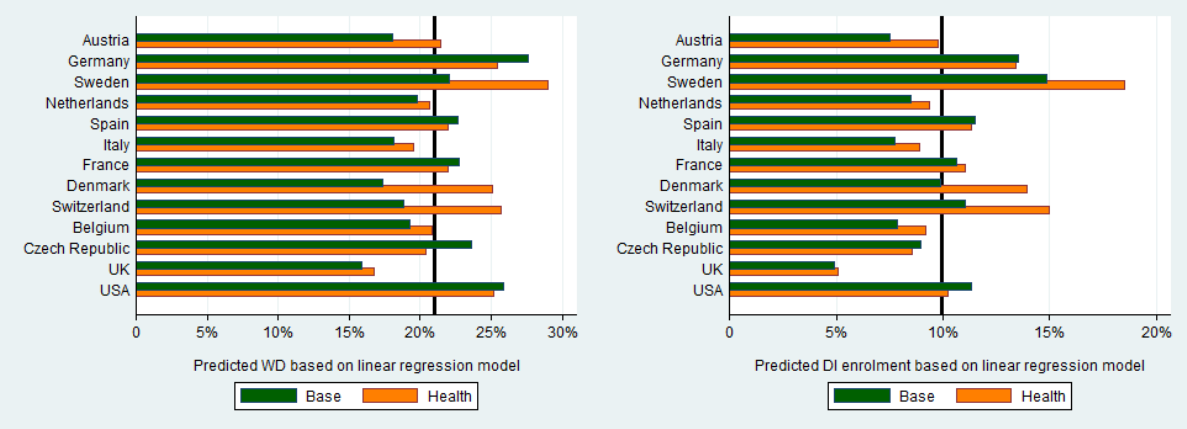


Source: Own calculations based on weighted data from SHARE Wave 5, ELSA Wave 6, HRS Wave 11.

In a second step, we account for differences in the health status of the population. The results are shown in Figure 9. Equalizing all current health measures generates more changes in the variation of WD and DI receipt than equalizing demographics. In countries with a good average population health, such as Sweden, Denmark and Switzerland, both WD rates and DI

enrolment rates would be much higher if they had the average health status. Countries with worse than average population health like the US reveal lower rates of DI uptake when simulating a relatively better health status. If health would be the main determinant for the variation of DI enrolment rates, the predicted counterfactual rates should move towards the average predicted DI rate (solid black line). As we can see, the counterfactual DI rates do not approach the mean DI rate, meaning that differences in health cannot be the explanation behind the between-country variation of WD and DI benefit receipt.

Figure 9: Counterfactual simulation for health

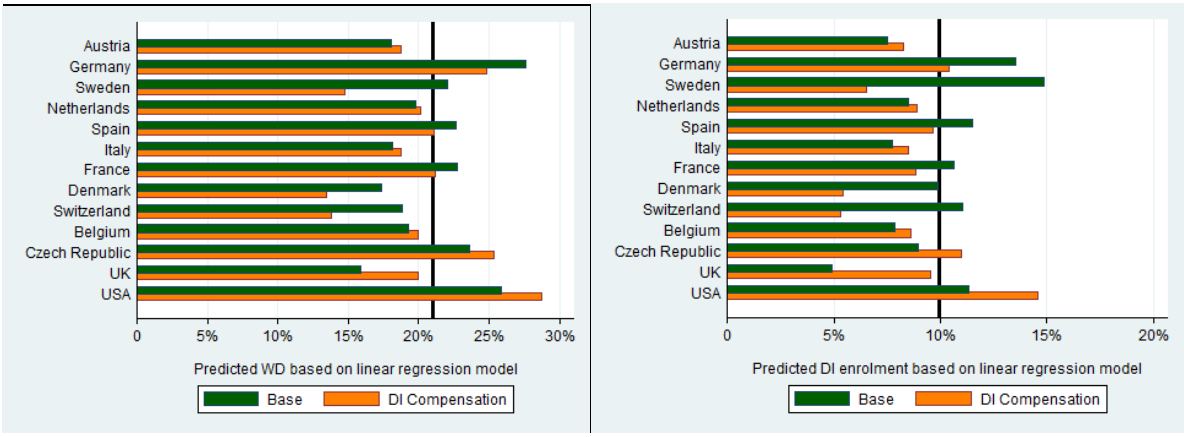


Source: Own calculations based on weighted data from SHARE Wave 5, ELSA Wave 6, HRS Wave 11.

The last counterfactual simulation is based on equalizing DI institutions across countries, i.e. we level the OECD policy summary indicator for all countries and then predict WD and the DI enrolment rates.[12] Thus, the institutional environment in countries like the UK and the US is assumed to become more generous, while countries like Sweden or Denmark become less generous when granting DI benefits. Figure 10 shows the predicted rates if the system characteristics were identical to the average in all countries of our cross-national sample.

[12] We also did the same exercise using the five subscales of the OECD policy indicator and the results are qualitatively the same.

Figure 10: Counterfactual simulation for OECD Policy indicators



Source: Own calculations based on weighted data from SHARE Wave 5, ELSA Wave 6, HRS Wave 11.

The pattern of DI uptake rates changes strikingly when equalizing the policy variables. In most countries, the counterfactual simulation leads to DI enrolment rates that approach the overall average DI rate. Exceptions are the most generous and at the same time the healthiest countries like Sweden, Switzerland and Denmark, where the simulated DI enrolment rates decrease far below the average DI rate of 9%. The contrary holds for the US which has one of the most restrictive DI regulations and on average an unhealthy population. In this case applying the average degree of generosity would increase the incentives to enroll in DI benefits and the simulated DI uptake rates grow up to 15%. Similar, but less pronounced effects can be found for the variation in self-reported work disability.

6. Conclusions

The objective of disability insurance (DI) is to provide basic protection for those who suffer from work disabilities (WD). This protection has two dimensions: protection from poverty by income support and protection from deteriorating health by permitting individuals to retire early. This study has evaluated both of the objectives of DI using harmonized data from SHARE, ELSA and HRS including life history variables. At the individual level within each of the 13 countries in this study, we found strong and equi-directional effects of current health and socio-demographic circumstances on reporting WD and receiving DI benefits.

Moreover, health experienced early in life matters a great deal for reported WD and DI receipt later in life. The life health variables are statistically highly significant and have large effect

sizes. They are the second most important group of variables explaining WD and DI after current health indicators. Thus, health problems experienced over the life course are important drivers of later life working capacity and the need to rely on DI benefits. Even illnesses experienced in childhood have long-term consequences. Social expenditures on health of children are therefore well spent since they do not only improve health but also have very long-term benefits for the onset of work disabilities and ultimately the reliance of DI benefit receipt.

Already on an individual level, we find that DI institutions matter for DI receipt. This effect is identified by the variation over time captured in the life histories. When DI systems became less generous, the likelihood of receiving DI pensions decreased, holding health and socio-demographic indicators constant. On the individual level, this effect is small compared to the variables measuring individual health as our variance decompositions show.

At the country level, however, the picture is dominated by factors describing the generosity of the DI systems while country differences in demographic characteristics such as population aging and health differences contribute very little in explaining the international variation in DI benefit receipt. In our counterfactual simulation exercises, DI enrolment rates approach the average DI rate when the policy variables are equalized. Exceptions are the healthiest and most generous countries such as Sweden, Switzerland and Denmark on the one hand, and the least healthy and most restrictive country, the US, on the other hand.

The large country differences may not be due to DI policies alone. More work is necessary to understand the precise interactions and causal chains among labor market environment, DI policies and long-term health effects, as well as the interactions between job characteristics and the medical and occupational assessment rules.

Given the large differences in the generosity and the prevalence of DI, and given the large costs of DI, the obvious next question is then whether the added expenses are well spent. Does a generous DI system improve individuals' wellbeing and health? Will this permit re-integration into the labor market? Further research is also needed to better understand which countries are successful by providing special employment programs or flexible work schemes following up on DI benefit receipt.

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